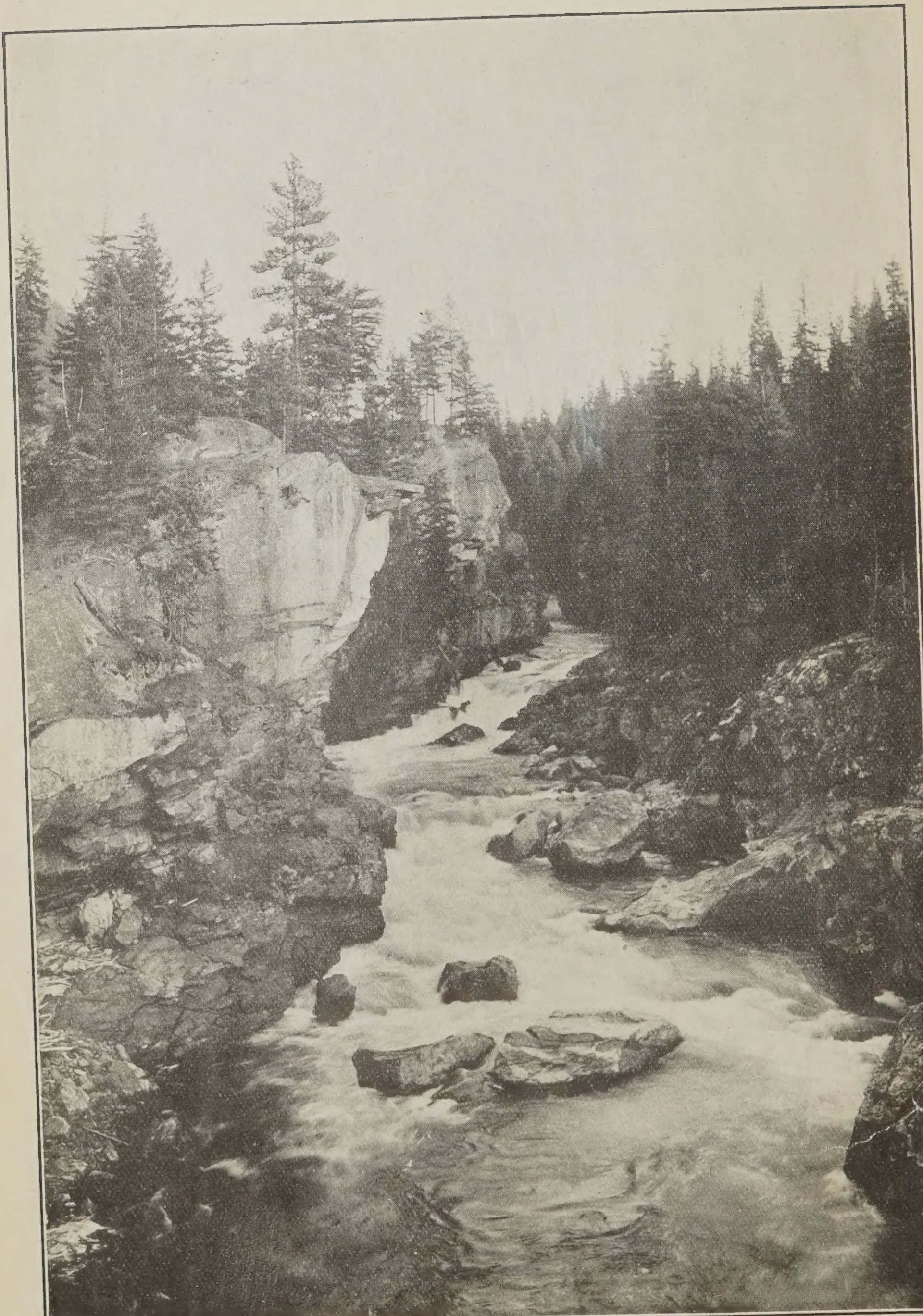
2.



Shuswap Falls, near site of proposed development of Coteau Hydro-Electric Company.

DEPARTMENT OF THE INTERIOR, CANADA

WATER POWER BRANCH

J. B. CHALLIES, Superintendent

WATER RESOURCES PAPER No. 8

REPORT

OF THE

BRITISH COLUMBIA HYDROGRAPHIC SURVEY

FOR

THE CALENDAR YEAR 1913

BY

R. G. SWAN, A.M. Can. Soc. C.E.

Chief Engineer.

OTTAWA

PRINTED BY J. DE L. TACHÉ, PRINTER TO THE KING'S MOST EXCELLENT MAJESTY

1915

To Field Marshal, His Royal Highness Prince Arthur William Patrick Albert, Duke of Connaught and of Strathearn, K.G., K.T., K.P., etc., etc., etc., Governor General and Commander in Chief of the Dominion of Canada.

MAY IT PLEASE YOUR ROYAL HIGHNESS:

The undersigned has the honour to lay before Your Royal Highness the British Columbia Hydrographic Survey Report for 1913.

Respectfully submitted,

W. J. ROCHE,
Minister of the Interior.

OTTAWA, July 1, 1914.

DEPARTMENT OF THE INTERIOR,

OTTAWA, July 1, 1914.

The Honourable W. J. ROCHE, M.D.,
Minister of the Interior.

SIR,—I have the honour to submit the British Columbia Hydrographic Survey Report for 1913, and to recommend that it be published as Water Resources Paper No. 8 of the Dominion Water Power Branch.

I have the honour to be, sir,

Your obedient servant,

W. W. CORY,
Deputy Minister of the Interior.

DEPARTMENT OF THE INTERIOR,

WATER POWER BRANCH,

OTTAWA, July 1, 1914.

W. W. CORY, ESQ., C.M.G.,
Deputy Minister of the Interior.

SIR,—I have the honour to submit the attached report by R. G. Swan, A M. Can. Soc. C.E., Chief Engineer of the British Columbia Hydrographic Survey.

In view of its important bearing on the industrial development of Southern British Columbia I would recommend that it be published as Water Resources Paper No. 8 of the Dominion Water Power Branch.

Respectfully submitted,

J. B. CHALLIES,
Superintendent, Dominion Water Power Branch.

OTTAWA, July 1, 1914.

J. B. CHALLIES, ESQ.,
Superintendent,
Dominion Water Power Branch,
Department of the Interior,
Ottawa.

SIR,—I have the honour to submit a brief report of the British Columbia Hydrographic Survey for the year 1913, together with the reports of the divisional engineers.

Allowance should be made for the fact that the reorganization, following the agreement between yourself and Mr. Wm. Young, Comptroller of Water Rights Victoria, B.C., regarding the gradual extension of territory of the Hydrographic Survey work by the Dominion Government from the Railway Belt to cover the entire province is still in progress. This agreement was only finally effected in September last by the formal approval of both Governments.

I have the honour to be, sir,

Your obedient servant,

R. G. SWAN,
Chief Engineer.

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REPORT

OF

BRITISH COLUMBIA HYDROGRAPHIC SURVEY FOR 1913

CHAPTER I

REPORT OF R. G. SWAN, A.M. Can. Soc. C.E.
Chief Engineer.

CHAPTER I.

REPORT OF THE CHIEF ENGINEER.

ORGANIZATION.

The personnel of the staff for 1913 was as follows:—

P. A. Carson, B.A., D.L.S., Chief Engineer (resigned July 31, 1913).
R. G. Swan, A.M. Can. Soc. C.E., Assistant Chief Engineer, June 1 to September 30; Chief Engineer, October 1.
E. M. Dann, D.L.S., Divisional Engineer.
C. G. Cline, Jr. Can. Soc. C.E., D.L.S., Divisional Engineer.
C. E. Richardson, A.M. Can. Soc. C.E., Divisional Engineer.
K. G. Chisholm, Assistant Engineer.
H. J. E. Keys, B.A., Assistant Engineer.
C. E. Webb, Assistant Engineer, from October 28, 1913.
J. A. Elliott, summer assistant (May 4 to September 17, 1913).
H. C. Hughes, summer assistant (May 13 to August 23, 1913).
A. T. Milner, clerical assistant from August 27, 1913.
Miss B. B. Allan, stenographer.
Miss W. M. Robinson, stenographer, from November 15, 1913.

The organization for the first nine months of the year was very similar to that of previous years and, although the work was still confined to the Railway Belt, a large number of new stations were established.

The Railway Belt at this time was divided into three divisions; Messrs. Cline and Chisolm were in charge of the district from the coast east to Deadman river; for five months during the summer period, Mr. Hughes was stationed at Indian river, rating the stations on the different streams in connection with the proposed development of the New Westminster Power Co. Mr. Keys was in charge of the district extending from the Deadman river east to grand Prairie; Mr. Richardson was in charge of the district from Grand Prairie to the eastern boundary of the province, with Mr. Elliott as a summer assistant on account of the large number of new stations established in this division.

Owing to Mr. Carson's frequent absences on inspection trips, Mr. Dann was stationed in the head office at Kamloops, having charge of the office from the first of the year until Mr. Carson's resignation. Mr. Dann was also in charge of special work in regard to streams tributary to the Shuswap lakes.

NATURE AND EXTENT OF WORK.

CHANGE IN WORK DUE TO THE AMENDMENT OF THE WATER ACT ASSENTED TO 6TH JUNE, 1913.

With the passing of the amendment to the Water Act the administration of all water within the Railway Belt passed under the exclusive control of the province of British Columbia, and the investigation into the water rights situation in the dry belt was carried on by the district engineers of the Water Rights Branch, Department of Lands, Victoria, B.C., thus allowing the Hydrographic Survey staff greater time for the extension of the study of the water supply and resources of the Railway Belt. For the same reason it has been possible to carry on the inspection of land applications under irrigation and reclamation conditions, and applications for foreshore rights, in a much more thorough manner than heretofore.

NEW WORK ENTERED INTO IN NEW DIVISIONS.

Following the agreement between yourself and Mr. Wm. Young, Comptroller of Water Rights, Department of Lands, Victoria, B.C., regarding the extension of territory of the Railway Belt Hydrographic Survey so that it will ultimately cover the entire province, and which agreement was finally given effect in September by the formal approval of both Governments, the following changes have been made in the organization of the work.

The title of the work has been changed from the "Railway Belt Hydrographic Survey" to the "British Columbia Hydrographic Survey," and the office of the chief engineer has been removed from Kamloops to Vancouver. The territory of the province has been divided for the present into three main divisions, with headquarters at Kamloops, New Westminster, and Nelson, where permanent office quarters have been provided for the division engineers of the respective divisions, namely, Mr. E. M. Dann, D.L.S., Mr. C. E. Richardson, A.M. Can. Soc. C.E., and Mr. C. G. Cline, Jr. Can. Soc. C.E., D.L.S.

In making the division of the province the mountain divides were followed, and the drainage areas, where possible, were kept intact.

Many new conditions arising from all these changes have affected the efficiency and effectiveness of our work and, owing to the lack of funds, very little new work has been undertaken except at the request of Mr. Young and co-operating parties. Now that the various division offices are becoming well organized, a good year's work should be accomplished if the staff required is made available.

COAST DIVISION.

C. G. Cline, Divisional Engineer.

At the request of the Bridge River Power Co., the maintenance of the station established by them on the Bridge river has been taken over by the survey.

As the province are making extensive surveys with regard to storage possbiilities for the water supply of Greater Vancouver, stations were established on Lynn, Capilano, and Seymour rivers.

In Pemberton Meadows, surveys are being made in connection with a project covering the drainage of land through which the Lillooet river flows and, as it is necessary to provide for the control of this river, a station was established. On Green and Cheakamus rivers there are good power possibilities and, as there have been several requests for data on these rivers, gauging stations were established at the same time as the station on the Lillooet river.

KAMLOOPS DIVISION.

E. M. Dann, Divisional Engineer.

By the time the arrangements for enlarging the work were completed, the season was so far advanced that it was practically impossible for Mr. Dann to establish any new stations in his division. He has, however, covered most of this territory, and will be able to make a vigorous start on this work in the spring. Many of the irrigation streams in the division are over-recorded, so that a very thorough study of the run-off must be made.

NELSON DIVISION.

C. E. Richardson, Divisional Engineer.

Previous to the time of the reorganization, Mr. Richardson's work in British Columbia had extended outside the Railway Belt. He had made several

trips with Mr. Biker, the Provincial Engineer, through the country in the vicinity of Nelson in connection with the proposed McKay reclamation scheme on the Upper Columbia, which required the establishment of several stations on the rivers tributary to the Columbia in the Windermere district, and as a result Mr. Richardson was familiar with a large part of this division before his transfer to Nelson.

During the fall, stations were established on the Columbia, Pend d'Oreille, Elk Bull, and Kootenay (two stations) rivers.

METERING STATIONS.

The following lists give: first, the regular metering stations; and second, rivers on which miscellaneous measurements have been made.

Coast Division.—List of Regular Metering Stations.

No. of Station.	River.	Location.
1000	Belknap creek at Belknap lake	Tp. 6, R. 7, W. 7 M.
1001	Boulder creek	Tp. 3, R. 27, W. 6 M.
1002	Brandt creek lower	Tp. 7, R. 7, W. 7 M.
1003	Chehalis river	Tp. 4, R. 30, W. 6 M.
1004	Chilliwack river	Tp. 23, ... E. C. M.
1005	Coquihalla river	Tp. 5, R. 26, W. 6 M.
1006	Coquitlam river	Tp. 5, R. 6, W. 7 M.
1007	Fraser river	Tp. 5, R. 26, W. 6 M.
1008	Gold creek	Tp. 39 .... W. C. M.
1009	Hixon creek, near mouth	Tp. 6, R. 7, W. 7 M.
1010	Jones creek	Tp. 3, R. 27, W. 6 M.
1011	Mesliloet river	Tp. 7, R. 7, W. 7 M.
1012	North Lillooet river	Tp. 12, ... E. C. M.
1013	Norton creek	Tp. 7, R. 7, W. 7 M.
1014	Rainbow creek	Tp. 6, R. 4, W. 7 M.
1015	Raven (Rushton) creek	Tp. 5, R. 4, W. 7 M.
1016	Silver creek (near Hope)	Tp. 5, R. 26, W. 6 M.
1017	Silver creek (tributary Pitt river)	Tp. 4, R. 5, W. 7 M.
1018	South Lilloooet river	Tp. 12, ... E. C. M.
1019	Stave river	Tp. 4, R. 3, W. 7 M.
1020	Young creek	Tp. 7, R. 7, W. 7 M.
1021	Brandt creek, upper	Tp. 7, R. 7, W. 7 M.

Kamloops Division.—List of Regular Metering Stations.

No. of Station.	River.	Location.
2000	Adams river	Tp. 23, R. 12, W. 6 M.
2001	Barnes creek	Tp. 20, R. 24, W. 6 M.
2002	Bolean creek	Tp. 18, R. 12, W. 6 M.
2003	Bonaparte river	Tp. 21, R. 24, W. 6 M.
2004	Campbell creek	Tp. 19, R. 16, W. 6 M.
2005	Cherry creek	Tp. 19, R. 19, W. 6 M.
2006	Coldwater river, Merritt	Water District No. 3.
2007	Criss creek	Tp. 22, R. 22, W. 6 M.
2008	Deadman river	Tp. 22, R. 22, W. 6 M.
2009	Deadman river	Tp. 21, R. 22, W. 6 M.
2010	Eagle river	Tp. 23, R. 6, W. 6 M.
2011	Essell creek	Tp. 17, R. 14, W. 6 M.
2012	Fraser river	Tp. 15, R. 27, W. 6 M.
2013	Greenstone creek	Tp. 17, R. 20, W. 6 M.
2014	Guichon creek, Mamit lake	Water District No. 3.
2015	Hat creek	Tp. 22, R. 25, W. 6 M.
2016	Hat creek	Tp. 19, R. 26, W. 6 M.
2017	Hat creek	Tp. 19, R. 26, W. 6 M.
2018	Hefferley creek	Tp. 22, R. 17, W. 6 M.
2019	Hefferley creek	Tp. 22, R. 16, W. 6 M.
2020	Ingram creek	Tp. 17, R. 13, W. 6 M.
2021	Jacko creek	Tp. 19, R. 18, W. 6 M.
2022	Jamieson creek	Tp. 22, R. 17, W. 6 M.
2023	Louis creek	Tp. 23, R. 15, W. 6 M.
2024	Monté creek	Tp. 19, R. 15, W. 6 M.
2025	Monté creek	Tp. 18, R. 14, W. 6 M.
2026	Monté creek	Tp. 18, R. 14, W. 6 M.
2027	Nahatlatch river, lower station	Tp. 2, R. 26, W. 6 M.
2028	Nahatlatch river, upper station	Tp. 12, R. 27, W. 6 M.
2029	Nicola river, Merritt	Water District No. 3.
2030	Nicola river	Tp. 17, R. 25, W. 6 M.
2031	Niskonlith creek	Tp. 21, R. 13, W. 6 M.
2032	Paul creek	Tp. 20, R. 15, W. 6 M.
2033	Paul creek	Tp. 20, R. 15, W. 6 M.
2034	Shuswap river	Tp. 18, R. 9, W. 6 M.
2035	Shuswap river, Lumby	Water District No. 4.
2036	Scottie creek	Tp. 23, R. 25, W. 6 M.
2037	Spius creek	Tp. 13, R. 23, W. 6 M.
2038	Stein creek	Tp. 15, R. 27, W. 6 M.
2039	Thompson river	Tp. 17, R. 25, W. 6 M.
2040	Thompson river	Tp. 17, R. 20, W. 6 M.
2041	North Thompson river	Tp. 21, R. 17, W. 6 M.
2042	South Thompson river	Tp. 21, R. 13, W. 6 M.
2043	Tranquille river	Tp. 23, R. 19, W. 6 M.

NELSON DIVISION.—List of Regular Metering Stations.

No. of Station.	River.	Location.
3000	Akolkole river	Tp. 21, R. 1, W. 6 M.
3001	Beaver river	Tp. 29, R. 25, W. 5 M.
3002	Blaeberry river	Tp. 28, R. 22, W. 5 M.
3003	Bugaboo creek, Spillimacheen	Water District No. 8.
3004	Columbia river, near Golden	Tp. 27, R. 22, W. 5 M.
3005	Columbia river, at Revelstoke	Tp. 23, R. 2, W. 6 M.
3006	Columbia river, at Castlegar	Water District No. 6.
3007	Columbia river, at Trail	Water District No. 6.
3008	Horsethief creek, at Wilmer	Water District No. 8.
3009	Illecillewaet river, at Revelstoke	Tp. 23, R. 2, W. 6 M.
3010	Illecillewaet river, at Glacier	Tp. 26, R. 26, W. 5, M.
3011	Kicking Horse river, at Golden	Tp. 27, R. 22, W. 5 M.
3012	Kicking Horse river, at Field	Tp. 28, R. 18, W. 5 M.
3013	Kicking Horse, No. 2 tunnel	Tp. 28, R. 18, W. 5 M.
3014	Kootenay river, at Glade	Water District No. 6.
3015	No. 2 creek, at Wilmer	Water District No. 8.
3016	Ottertail river	Tp. 27, R. 19, W. 5 M.
3017	Pend d'Oreille river, at Waneta	Water District No. 6.
3018	Slocan river at Slocan	Water District No. 6.
3019	Spillimacheen river, at Spillimacheen	Water District No. 8.
3020	Toby creek, at Athalmere	Water District No. 8.

MISCELLANEOUS METERING STATIONS.

Miscellaneous meterings were taken on the following rivers and creeks:—

COAST DIVISION—MISCELLANEOUS METERING STATIONS.

Belknap, Bridge, Capilano, Cheakamus, Green, Hixon, Lillooet, Lynn, Seymour, Slollicum.

KAMLOOPS DIVISION.—MISCELLANEOUS METERING STATIONS.

Bear, Campbell, Cache, Cornwall, Cleme's, Dairy, Duffy, Eagle, Eight-mile, Fortunes, Fadear, Gordon, Highfalls, Mission, Murray, Maiden, Nelson, Oregon Jack, Power, Ross Ray, Scotch, Shuswap, Seymour, Three-mile, Tulameen, Twenty-mile, Twall, Venables.

NELSON DIVISION.—MISCELLANEOUS METERING STATIONS.

Incomappleux, Yoho.

Many of the metering stations were established too late in the fall to get a sufficient number of measurements to plot the hydrographs from which the daily flow data are computed. The available data on these rivers are recorded as miscellaneous measurements.

The stations on these rivers will be maintained during the coming year as regular metering stations.

OUTLINE OF WORK FOR NEXT YEAR.

Up to the present time the yearly appropriation has not been sufficient to maintain the engineers in the field during the winter months. A few miscellaneous winter measurements have been taken, but there are no complete yearly run-off records except on those rivers in the Coast division which do not freeze up. From the time the survey was organized, a particularly thorough study has been made of the irrigation streams in the dry belt, and for the last three years the data on these streams, during the irrigation period, are very complete.

In the Nelson division the climate is humid, and little water is used for irrigation, the more important uses of water being for power, lumbering, and municipal water supply. It is readily seen that only seven or eight months run-off records for each year greatly limit the value of these data. The situation as regards power and municipal water supply in the Kamloops division is much the same and, although the power possibilities may not be so great as in the Nelson division they are equally important. If the appropriation for the survey is sufficient, it is my intention to have the engineers who are making a study of power and municipal water supply, maintained in the field during the entire year.

To keep pace with the increasing demand for hydrographic data, it is essential that the staff be sufficiently increased to maintain nine hydrographic parties in the field. New lines of railroad are rapidly opening up new country which will, in the near future, demand the utilization of the water resources.

Transportation has been the big item in the maintenance of the parties in the field, and this, I think, should be minimized if the territory to be covered in the different divisions be divided as follows, and worked from the most central city or town.

COAST DIVISION.

(1) Vancouver to cover Railway Belt and south to the boundary.

(2) Victoria to cover Vancouver island and territory north along the coast of the province.

(3) Lillooet to cover the territory along the Pacific Great Eastern.

KAMLOOPS DIVISION.

(1) Kamloops to cover the local irrigation streams, the rivers along the Canadian Northern railway to Yellow Head pass and the rivers tributary to Shuswap lake.

(2) Ashcroft to cover the rivers in Ashcroft and Merritt vicinity.

(3) Penticton to cover Okanagan river and its tributaries.

NELSON DIVISION.

(1) Golden to cover Upper Columbia river and tributaries.

(2) Nelson to cover Lower Columbia river and Kettle river and their tributaries.

(3) Cranbrook to cover Kootenay river and tributaries.

DEFINITION OF TERMS.

The volume of water flowing in a stream-run-off or discharge is expressed in various terms, each of which has become associated with a certain class of work. Some of the terms generally used are: "Second-feet," "gallons per minute," "discharge in second-feet per square mile," "Run-off depth in inches on drainage area," and "total run-off in acre-feet."

"Second-feet" is an abbreviation for cubic feet per second, and is the unit for the rate of discharge of water flowing in a stream 1 foot wide, 1 foot deep, at the rate of 1 foot per second.

"Second-feet per square mile" is the average number of cubic feet of water flowing per second for each square mile of drainage area.

"Run-off in inches" is the depth by which the drainage area would be covered if all the water flowing from it were uniformly distributed on the surface. It is used for comparing run-off with rainfall, which is usually given in inches.

An "foot-acre" is equivalent to 43,560 cubic feet, that is, the quantity required to cover an acre to the depth of 1 foot, and is commonly used in connection with storage.

CONVENIENT EQUIVALENTS.

The following is a list of convenient equivalents for use in hydraulic computations:—

1 second-foot equals 6.24 British imperial gallons per second.
1 second-foot equals 7.48 United States gallons per second.
1 second-foot for one day covers 1 square mile 0.03719 inch deep.
1 second-foot for one day equals 1.983 acre-feet.
1 acre-foot equals 325,850 United States gallons.
1 inch deep on 1 square mile equals 2,323,200 cubic feet.
1 acre equals 43,560 square feet.
1 cubic foot equals 6.24 gallons.
1 cubic foot of water weighs 6.24 pounds.
1 horse-power equals 550-foot pounds per second.
1 horse-power equals 1 second-foot falling 8.80 feet.
1 horse-power equals 746 watts.
$1\frac{1}{3}$ horse-power equals about 1 kilowatt.

To calculate water-power quickly $\dfrac{\text{sec.-feet x fall in feet}}{11}$ = net horse-power on water wheel realizing 80 per cent of theoretical power.

GENERAL METHODS OF STREAM MEASUREMENTS.

In measuring the flow of streams the basic assumption is that the discharge of the stream varies with the stage, or in other words that for a given stage there is a corresponding discharge. Where this relation holds, it is possible, by taking a series of measurements of the discharge and noting the corresponding stages, to plot a curve which will give the relation between stage and discharge. Having determined such a relation, it is only necessary to take daily records of the stage of the stream in order to compute the daily discharge.

The stage of the stream is measured by some form of stream gauge which gives the elevation of the surface of the water above a fixed datum. The types of gauges in use by this survey are the staff gauge, the chain gauge, and the recording gauge. The vertical staff gauge is used wherever possible. In some cases, however, where it is impossible to use a staff gauge, a chain gauge or a recording gauge is installed, depending on the different conditions encountered.

The standard method for the measurement of discharge is by the use of the current-meter. The instrument used is the small Price electric current-meter (No. 623, manufactured by W. & L. E. Gurley, Troy, N.Y.). In this method the area of the section is determined by taking soundings at measured intervals across the stream, the mean velocity is determined by a series of readings of the current-meter, and from these two sets of measurements the discharge is calculated.

Occasionally circumstances arise under which it is permissible to use other methods for measuring discharge. In very small irrigation ditches, where the cross-sectional area of the water would greatly disturb the natural flow, an approximate measurement can be made by means of surface-floats. The surface-float method is occasionally used for the measurement of flood discharges in very large streams where, owing to the high velocity, the ordinary equipment could not be used.

From investigations made by this survey on the larger streams in this province, the average velocity ranges from 0.85 to 0.90 of the surface velocity, so that the mean surface velocity in feet per second, multiplied by the cross-sectional area in square feet, multiplied by a constant K (the said constant ranging as stated above from 0.85 to 0.90) is equal to the discharge in second-feet.

The weir method might be used occasionally on very small irrigation streams, provided it is placed in such a position as not to affect the level of the water at the existing gauge. On the larger streams, the expense of constructing the weir for measurement purposes only, is too great, and there are very few dams in the province which could be so used. The use of weirs for obtaining the daily discharge of a stream is not recommended on account of the greater accuracy necessary in taking the readings, the errors introduced by material logging against the crest and the difficulties of getting a weir that will be accurate at all stages of the stream. Nevertheless where the person who is to take the daily readings thoroughly understands all the requirements necessary for accurate weir measurements, this method gives very good results.

ACKNOWLEDGMENTS.

For the courtesy extended in the compilation of the data for this report, special thanks are due the following:—

G. R. G. Conway, Chief Engineer of the British Columbia Electric Railway;
R. G. Hayward, Chief Engineer of the Western Canada Power Co;
A. R. MacKenzie of the Couteau Power Company;
Wm. Young, Comptroller of Water Rights, Victoria;
W. R. Bonnycastle, Consulting Engineer; and others;

REPORT

OF

BRITISH COLUMBIA HYDROGRAPHIC SURVEY FOR 1913

CHAPTER 2

Coast Division

REPORT OF C. G. CLINE, Jr. Can. Soc. C.E., D.L.S.,
Divisional Engineer

CHAPTER II.

COAST DIVISION.

The division of the province for the work of the British Columbia Hydrographic Survey has been made with a view to facilitating the work as much as possible. Drainage areas have been kept intact as nearly as possible, the dividing lines following the watersheds. For this reason it is difficult to definitely describe the boundaries of the Coast division, but they may be readily seen by referring to the map accompanying this report.

The hydrographic work on the streams in the Railway Belt, which was commenced in 1911 and 1912, has been continued, and there are now two years' complete records for many of them. In addition to this work, regular stations have been established on a number of streams outside the Railway Belt, including those at North Vancouver and those between Squamish and Lillooet near the route of the Pacific Great Eastern railway. Most of these streams are listed under "Miscellaneous Measurements," having regular stations, and will appear as such in the 1914 report wherever sufficient meter measurements have been taken to relate the gauge readings to the discharge.

A considerable amount of work has already been done on Vancouver island by the engineers of the Water Rights Branch of the Provincial Government and the results of their work is contained in the 1913 report of that branch. It is expected that the stream measurement on the island in 1914 will be done by the British Columbia Hydrographic Survey while, in addition to this new work, it is expected that a number of new stations will be established in the Coast division, particularly in the vicinity of Lillooet. The measurements and records on the older stations and on the new ones already established will be continued, and their accuracy and reliability increased wherever possible.

Reclamation-Pitt Meadows Dyke South of Sturgeon Slough.

A general description of the main characteristics of this part of the province is here given, special attention being paid to all matters pertaining to the use and control of the streams. Following the general description is the information and data on the individual streams.

Reclamation-Pitt Meadows Dyke South of Sturgeon Slough.

CLIMATE.

The climate of Vancouver island and the coast generally, corresponds very closely with that of England; the summers are fine and warm, with bright sunshine, and severe frost scarcely ever occurs in winter. On the mainland, similar conditions prevail till the higher levels are reached, where the winters are colder. Summer frosts are rare except in the higher altitudes. The rainfall, generally speaking, is heavy, but the greater portion falls during the autumn and winter. Farther north, and in the higher altitudes, the winters are more severe and the annual precipitation lighter.

On the report on each stream in the Coast division will be found notes on the general climatic conditions, annual precipitation, etc. The records from the meteorological stations in the Coast division are used for this purpose whenever available.

AGRICULTURE.

The area of valuable agricultural land in the Coast district is very difficult to estimate on account of the very rugged and mountainous nature of the country. There is, however, a far larger area than one is led to believe on a superficial view of the country, as many of the valleys and benches which appear to be narrow, stony, and worthless, often prove to be of great agricultural value. Only a small portion of the available lands have as yet been taken up owing to the heavy cost of clearing and the lack of transportation facilities in many parts. The latter, however, is being gradually overcome with the construction of new railways.

The great proportion of the agricultural areas lies in the valleys and lower benches, but the higher altitudes are often found to contain good grazing areas. All the ordinary fruit and field crops do well in the lower altitudes, while the higher areas are used for raising hay, and grazing.

In this district, diversified farming is gradually superseding special farming, as it is found to be more profitable than any special branch of the industry, except in districts immediately adjoining the larger centres of population.

The rapid growth of the Coast cities has led to the lands in their vicinity to be used almost exclusively for supplying the vegetables, fruits, poultry, and dairy products where an ever-increasing market is found, making this branch of farming a very profitable industry.

Districts, remote from railways and other means of cheap transportation, have been confined more particularly to raising cattle and horses. This is particularly true of Pemberton Meadows and the Lillooet country. In order to winter the stock it is necessary to grow hay and other forage crops, while a certain amount of fruit and vegetables are grown for local use. With the completion of the Pacific Great Eastern railway, this district will probably develop into a mixed-farming country.

IRRIGATION.

Irrigation is necessary in only a small portion of the Coast division, and the apportionment of water for such a purpose is not so great a problem as in some other parts of the province, although the proximity of a large irrigation country affords demonstration of the advantages of irrigation, and the mountainous nature of the country allows the method to be readily applied wherever it is desirable.

Reclamation-Pitt Meadows Pump House and Sluice Gates.

Along the coast and for many miles inland, the rainfall is so heavy that the farmer requires special means of drainage. However, much of this precipitation falls in the winter, and not during the growing season, hence there is much less moisture than the figures for the annual precipitation would seem to indicate. In the vicinity of Hope, where there is a mean annual rainfall of some 50 inches, irrigation is practised to a certain extent and promotes crops during a dry summer.

Some of the country in the vicinity of Lillooet is included in the Coast division though climatically it is part of the dry belt. Here irrigation is necessary to produce, crops, and the supply of water is rather limited. It is our intention to make a comprehensive study of the various sources that might be used for such a purpose, so that the Provincial Water Rights Branch may be supplied with all stream-flow data necessary for the proper administration of the water resources of that district. The results obtained will also be available for the water users themselves, and should be of considerable assistance in designing engineering works of any magnitude.

Reclamation-Pitt Meadows looking North of Sturgeon Slough showing flooded land to be reclaimed.

RECLAMATION.

Some of the most fertile agricultural land in the province is to be found in the rich alluvial meadows which comprise the delta of the Fraser river. These areas, being low, are subject to floods at certain seasons, and require dyking. There are other places also in the Coast division in which dyking or some form of reclamation is necessary. Wherever the work of this survey is connected with such projects, every assistance possible is rendered, and when there are streams to be diverted or otherwise controlled, the stream-flow data are particularly valuable.

LUMBERING.

It is estimated by the Provincial Forestry Branch that in the entire province there are over 100,000,000 acres of timber land, of which about 65,000,000 acres possess a topography and soil which will permit of the production of merchantable timber, which, when transportation means become available, can be profitably logged.

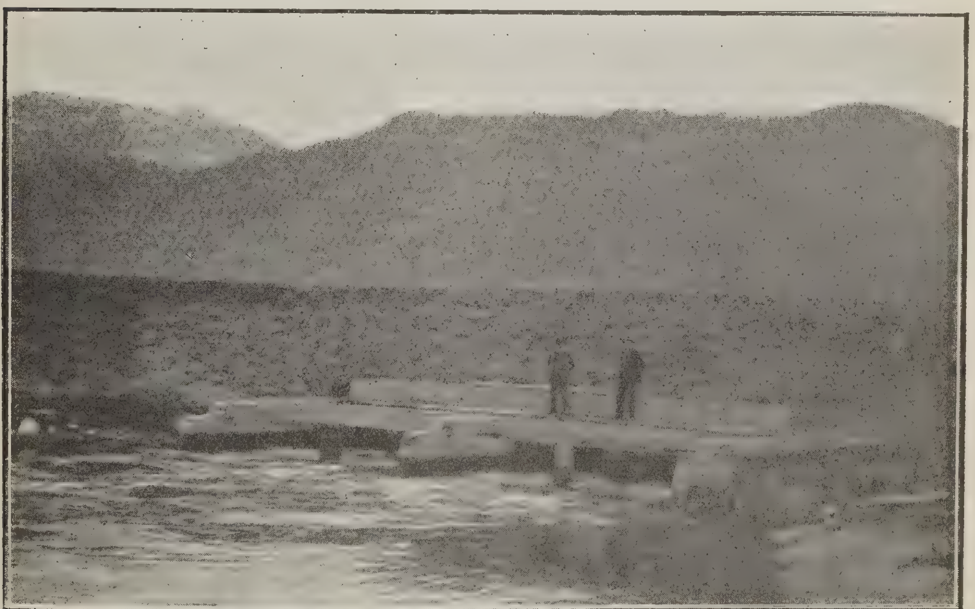
The present stand of merchantable timber in the province is estimated roughly at three hundred billion board feet. A conservative estimate places the amount of timber which can be cut annually without endangering the forests of the province at six and a half billion board feet; the amount of timber cut annually at present is only about one-fifth of this. Hence, as the demand for lumber increases the annual cut will be increased until the maximum economic amount is reached.

During 1912, about 75 per cent of the total amount of timber cut in the province came from the Coast district. The figures show a cut in this part of of the province of some seven hundred and eighty million board feet, composed mainly of fir and cedar, which grow to an immense size in the mild, moist climate of the coast.

Most of the lumbering is done during the summer months when the weather is mild and there is comparatively little rain, the logs being hauled through the woods by "donkey" engines and heavy steel cables to tide water or to the larger rivers, whence they can be floated to the mills. In some cases logging railroads are being built to reach the timber more distant from the waterways.

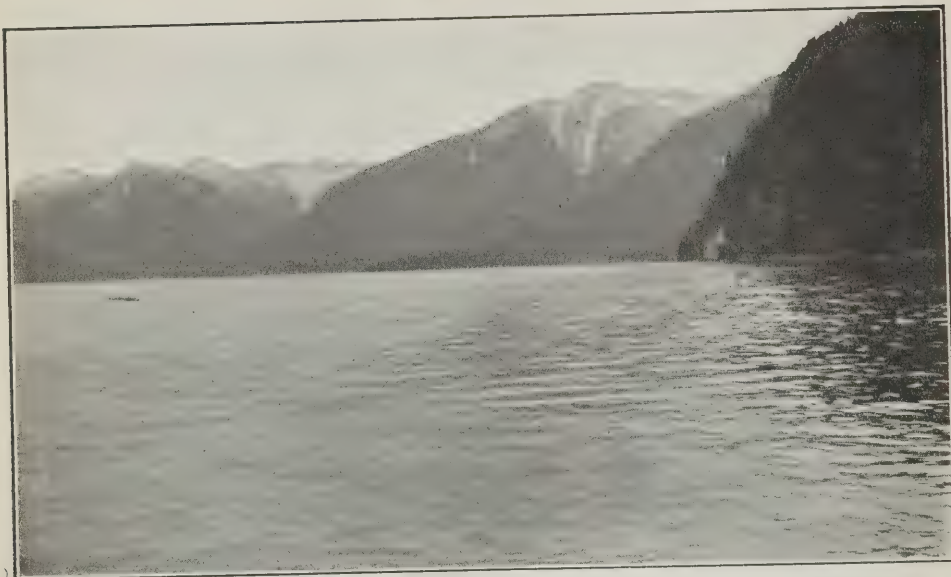
A number of the streams in the Coast division are used for running logs but only in the largest can logs be run at all seasons. Even during the heavier freshets, great difficulty is experienced on many of the streams, and in some cases the practice has been abandoned entirely. The great size of the logs makes it very difficult to run them, and logging railroads are gradually being adopted.

The large amount of territory which is covered by forest growth has a great effect in regulating the run-off of all the streams in the Coast division, the heavy foliage and dense underbrush holding the moisture. At the headwaters of most of the streams, very little timber has been removed, and this, together with the high altitude, tends to keep the winter snows from melting off entirely until well on in the summer. As there are heavy rains in the fall, the period of low water during the summer and fall is very short.



Reclamation—Pitt Meadows Dyke and Sluice Gates.

There are large tracts of country in the Coast division which are of greater value for timber than for any other purpose. Much of the land is rough, mountainous, and unsuitable for agriculture, while the timber produced is very valuable.



Pitt Lake from Mouth of Raven Creek.

FISHING.

Fishing is one of the largest industries in British Columbia, and is one that must be seriously considered in all power development schemes in order that this important industry shall not, in any way, be damaged.

Until recently commercial fishing was practically confined to the salmon which swarm in myriads up the rivers to the quieter waters in order to spawn. Now, however, the industry has largely developed and many other branches of fishing have been developed. In 1910 the catch of halibut in British Columbia was 21,500,000 pounds out of a total catch for the Dominion of 23,000,000 pounds. It will thus be seen that other branches of fishing are being largely developed.

The preservation of the salmon is almost a vital necessity to the province, and to that end a number of hatcheries have been established on the inland waters. No obstruction should be allowed to remain in any stream to hinder the fish from reaching the spawning grounds. For instance, if any considerable portion of the Fraser river or its tributaries was blocked for a single season so that the fish could not spawn, it would seriously diminish the run of salmon in the Fraser, four years later, and probably have considerable effect also on the run eight years and even twelve years after.

British Columbia is the anglers paradise. Thousands of tourists come here year after year to indulge in this sport on the inland lakes and streams where, with ideal surroundings, some of the finest fishing of the world is found. Every effort should be made to protect the fish and hence it is necessary to enforce certain restrictions on the use of the streams.

In every power development which includes any form of dam across the stream in the Coast division, proper provision should be made for the passage of salmon and other fish. This is particularly so in the case of the Fraser river.

It is neceesary to preserve the forest cover in order to maintain a regular stream flow. In such cases it would probably be best to reserve the timber, as was done by the Dominion Government in the case of the territory surrounding

Coquitlam lake, which provides the water supply for the city of New Westminster and also for the Vancouver Power Company's plant on Burrard inlet; the country surrounding this lake has been made into a reservation, and the land is not open for settlement.

SEWAGE DISPOSAL.

Special precautions are taken to keep the inland waters pure for the sake of the fish. In construction camps, as well as in more permanent settlements, it is not permissible to run untreated sewage into streams or lakes. Some fairly efficient form of treatment is necessary if it is to be disposed of in such a way. This is altogether apart from more stringent measures which may be necessary when a source of municipal water supply is likely to be effected.

INDUSTRIAL WASTE.

The disposal of sawdust or other industrial wastes in the streams is a great danger, as the fish are apt to mistake such things for food and be seriously injured thereby. Engineers and others establishing camps or factories at the coast would do well to see the regulations regarding the pollution of streams by all such waste materials.

TRANSPORTATION.

The history of British Columbia is composed to a great extent of the development of the transportation facilities of the province, and it will be necessary to continue this development for many years to come. In a mountainous country like this, it is no easy matter to build trails and roads, and the construction of railroads is much more difficult and expensive than in the other provinces, but still good progress has been made in the last few years, and conditions are gradually improving.

The Canadian Pacific railway has, since its construction, been the main line of traffic in British Columbia and for many years it was the only railroad in the province. Now, however, there are a number of other roads in operation or under construction in the Coast division, as well as in other parts. The Canadian Northern Pacific parallels the Canadian Pacific on the opposite side of the Fraser river. The British Columbia Electric Railway Company has interurban lines connecting Vancouver, Steveston, New Westminster, and Chilliwack. The Kettle Valley railway and the Vancouver Victoria and Eastern railway are being built up the Coquihalla river. The Pacific Great Eastern railway will connect North Vancouver, Squamish, Lillooet, and Fort George. A few miles of this road is being operated at present, and it is predicted that trains will be running from Squamish to Lillooet by the end of 1914. There are also a number of railways on Vancouver island.

The waterways of the Coast division are of considerable assistance in providing transportation. There are a number of steamships plying between various points along the coast. A couple of small steamers run up the lower Fraser river. Pitt lake and Harrison lake and the rivers which flow out of them can be navigated by motor launches, and provide access to streams which cannot be reached by any other means.

The mileage of roadways in this part of the province is quite small. There are roads in and around the more important centres, but as a rule they do not extend any great distance. There are roads along both sides of the Fraser river as far as Ruskin on the north side, and Hope on the south, and a number of crossroads have been opened out from both of them. The construction of new roads is necessarily slow, but from year to year new ones are built opening up new districts.

Foreshore—Pitt River.

Foreshore—Pitt River.

Work has been progressing for some time on the new Pacific highway which it is proposed to extend eventually right across British Columbia to the prairies, and to make of it a great automobile highway for tourists traffic, as well as providing for local transportation. This road is to run from Vancouver,

through New Westminster and Chilliwack, and follow up Silver creek and across the divide to Princeton. When completed it will give access to the Skagit river.

In the Coast division it has been necessary for us to use practically every means of transportation at some time or other, at times being compelled to travel long distances on foot, sometimes carrying considerable packs. We use the best means of transportation available for our purposes, but circumstances sometimes make it necessary to fall back on some of the more primitive methods.

Transportation conditions in British Columbia have been outlined above mainly with a view to show their influence on the work of the British Columbia Hydrographic Survey. These same conditions, of course, have a great effect on the trade, commerce, and industry of the province and, with the improvement of the shipping facilities by rail and steamboat, the prosperity of the province is bound to increase. Every such development, therefore, is bound to add to the demand for electric power, both for transportation and for manufacturing, and hence increase the value of the water-power sites of the province.

MINING.

There is considerable mining activity in the territory included in the Coast division. The most important product is coal from the mines on Vancouver island. The value of the coal mined in 1912 was nearly five and a half million dollars. One of the most important producers was the Canadian Colliers, Ltd. This firm operates a number of mines in the vicinity of Union bay, and has several small railroad lines to convey the coal to tide-water. Power for these enterprises is now obtained from a hydro-electric plant on Puntledge river.

The Vancouver Portland Cement Co. at Todd inlet, on Vancouver island, which is operated by electric power transmitted from the British Columbia Electric Company's plant at Goldstream produces about $800,000 worth of cement annually.

The mining industry will probably utilize a larger amount of water-power in the future than it does at present. At one time considerable placer mining was done in the Coast division, and a large number of water records were taken out for this purpose. The placer deposits in this part of the province are not being worked to any extent now, though a few hydraulic mines are in operation in the Cariboo. As transportation and labour conditions improve, however, and better smelting facilities are provided, there will probably be an increase in the number of mines working on low grade ores and on the baser metals. In such mines it is necessary to handle a large tonnage cheaply in order to make the properties pay and a good supply of cheap power would be a considerable advantage. The Canadian Colliers serves as an example of the superiority of water-power over steam-power even when a cheap supply of fuel is available. It is to be expected that other companies operating mines of a permanent nature will follow this firm's example.

MANUFACTURING.

British Columbia is not as yet a great manufacturing province, though the value of the industries are gradually increasing, but the introduction of hydro-electric power and the improved transportation facilities are bound to promote industrial development in the province.

The electrical transmission of power has greatly benefitted certain industries which are carried on in the cities; and many other industries have been developed close to the sources of power so as to escape transmission charges. In the older parts of the country there has been a great increase in the use of water-power within the last decade or two, and great improvements have been made.

WATER-POWER.

In the Coast division there are a large number of good sites for developing water-power in various amounts. Several plants have already been constructed, and a number of other propositions are being investigated by various companies and individuals. The power possibilities, if any, of each stream which has been investigated by the engineers of this survey are described, and where plants have already been constructed or where it is proposed to construct them, descriptions are also given.

PLANTS ON STREAMS INVESTIGATED WITHIN THE RAILWAY BELT.

Coquitlam River.

The Vancouver Power Company generates its power mainly at its two plants on Buntzen lake. These plants are situated on the North Arm of Burrard inlet and use the water of the Coquitlam river under a head of 400 feet. There is a storage dam on lake Coquitlam, and the water is conveyed through a tunnel 12,775 feet long to lake Buntzen. This latter lake acts as an equalizing reservoir, and from it the water is led through penstocks to the power-house.

The power generated is used for lighting and industrial purposes in Vancouver, New Westminster, Steveston, Chilliwack, and the lower mainland generally, as well as for operating city and interurban car lines in the same district.

Stave River.

The Western Canada Power Company has a plant on the Stave river at Stave falls. A series of dams near the power-house raises the level of Stave lake, and provides good storage. Short steel penstocks carry the water from the dam to the power-house. The head varies from 100 to 120 feet according to the level of the lake.

Gilley Creek.

Gilley Bros., of New Westminster, operate a rock quarry on Pitt lake by means of water-power from Gilley creek. A wooden stave pipe is used to convey the water to two small Pelton wheels which drive the screening plant and air compressor mechanically. A third wheel is used to drive a small dynamo which supplies current for lighting at night. There is a storage dam on Munro lake to regulate the flow of the stream. The total available head is about 2,000 feet, but only 600 feet is being used at present.

The flow of this stream was given in the annual report for 1911 and 1912.

DEVELOPED POWER SITES ON STREAMS OUTSIDE RAILWAY BELT.

Jordan River.

The Vancouver Island Power Company has a plant on Jordan river and supplies power to the Victoria branch of the British Columbia Electric Railway Company.

Puntledge River.

The Canadian Colliers, Ltd., has a plant on Puntledge river near Union bay on the east coast of Vancouver island, supplying power to a number of mines and operating electric railways connecting the mines with tide-water. This plant is referred to under the heading "Mining" in the "General Report.'

Powell River.

There is a water-power plant on the Powell river, which operates a large pulp-mill by direct mechanical drive.

UNDEVELOPED POWER SITES—IN TERRITORY ALREADY COVERED, NOT INCLUDING VANCOUVER ISLAND AND OTHER PARTS OF THE COAST DIVISION.

Bridge River.

A head of 2,000 feet could be developed at Bridge river by driving a tunnel through the ridge separating it from Seton lake. The water would be diverted into the tunnel from Bridge river and conveyed from the other portal by steel penstocks to the power-house situated on Seton lake.

A great amount of power could be developed here, but the cost of the tunnel would render a large initial development necessary. The Pacific Great Eastern railway, which is being constructed along the north side of Seton lake, would provide good transportation but extra precaution would have to be taken to prevent a washout by any leaks or breaks in the tunnel or penstocks. Special provision might have to be made for carrying the extra discharge from Seton lake.

Chehalis River.

The plan of development on this stream includes a storage and intake dam near the lower end of Chehalis lake, and a large concrete pipeline, some 10 miles in length, to an equalizing reservoir near the mouth of the river. The penstocks would lead from the reservoir to the power-house, and would give a head of about 400 feet. Chehalis lake would give splendid storage. It might be possible to divert the flow of the west fork (Statlu creek) into the lake or into the pipeline.

It is not possible to maintain a gauging station near the lake for lack of a gauge reader. The flow given at the station at the mouth must be greatly reduced to give the flow available.

Chilliwack River.

Chilliwack river is quite a large stream, having a fall of about 2,000 feet between Chilliwack lake and the Fraser river.

At one time it was proposed to carry water from Chilliwack lake to Jones lake, but this scheme was abandoned owing to the heavy expense which would be involved, and also as it was found that Chilliwack lake was not at a sufficiently high elevation above Jones lake.

Another proposal is to construct a tunnel from the Upper Chilliwack valley to the valley of the Fraser river. This plan is probably quite feasible, but sufficient surveys have not been made to develop all its features. On account of the great expense of the tunnel, it would be necessary to make a large initial development.

Coquihalla River.

About 6 miles from Hope, and just above the mouth of the Nicolum river, the Coquihalla flows through a narrow gorge from 30 to 70 feet wide. The precipitous rock walls rise to a height of 150 feet. By constructing a dam at this canyon, a head of 100 or 125 feet could be obtained. The power-house could be built opposite the mouth of the Nicolum river, and the water conveyed to it from the dam through a tunnel.

Below the mouth of the Nicolum river is another small canyon and falls (Natural Bridge), but it would be rather expensive to utilize this fall with the other.

The gauging station gives the flow of the whole river, including that of the Nicolum, but the waters of this stream could not be used in the upper development.

Green River.

At Nairn falls there is a good site for a development. An intake dam could be built on a rock foundation above the falls and connected by a short penstock with the power-house built below the falls. The Pacific Great Eastern railway is being built along the river bank within a few hundred feet of the falls, and would give good transportation.

The presence of the railway along the east shore of Green lake will seriously interfere with the use of the lake for storage, and there would be very little pondage at the falls, but it might be possible to store water on the tributaries, Soo river or Six-mile creek.

Jones Creek.

The Vancouver Power Company has been investigating Jones creek as a possible source of power. The plan is to drive a tunnel through the ridge between Jones lake and the Fraser valley. The tunnel would be 10,200 feet long. Steel penstocks, 6,000 feet in length, would lead from the portal to the power-house on the bank of the Fraser river.

A dam near the outlet of the lake would provide considerable storage. Boulder creek could easily be diverted into the lake. This plant would utilize the combined flow of Jones and Boulder creeks, and would be fairly well regulated by the storage in Jones lake, under a head of 1,800 feet.

Mesliloet (Indian) River and tributaries.

The Westminster Power Company proposes to develop power from the Mesliloet river and tributaries, and have already made extension surveys. Splendid storage facilities are available in Norton, Young, and Ann lakes; from the first named lake a head of 2,000 feet could be developed.

North Lillooet River.

A small amount of power could be developed at a falls on the North Lillooet river. The municipality of Maple Ridge, however, has applied for the right to use part of the water for domestic purposes.

Rainbow Creek.

A series of falls near the mouth of the creek give a head of 630 feet in about half a mile. A small diversion dam could be built at the head of the falls to turn the water into the pipeline. A power-house could be built on the flat at the mouth of the river, a few hundred feet from Pitt lake.

Raven (Rushton) Creek.

This is a small creek flowing into Pitt lake. Rushton lake is 700 feet above Pitt lake and only 4,000 feet distant. About 1,000 feet from Pitt lake there is a fall of 100 feet. Mr. E. J. Fader proposes to run a pipeline from the head of the falls to a power-house to be built near the mouth of the creek. The power is to be used for running a rock quarry and gravel screening plant, neither of which have been built as yet.

Silver Creek (near Hope).

It would be quite possible to develop power on Silver creek which flows into the Fraser river, near Hope, though as yet no definite details of any such scheme have been worked out. There is a fall of 1,100 feet from Silver lake to the Fraser, but it is pretty evenly distributed over a distance of 5 miles. A long flume line would be necessary to develop any considerable amount of power. Silver lake might be used for storage as long as it did not damage the Pacific highway which is being built up the creek valley and along the lake.

Silver Creek (tributary Pitt river).

This stream might be used for developing a small amount of power, but the municipality of Coquitlam is planning to obtain its water supply from it.

Slollicum Creek.

This small stream discharges into an arm of Harrison lake. It has a series of falls near the mouth, with a total drop of 2,000 feet in about half a mile.

South Lillooet River.

Various plans have been proposed at different times for developing power on this stream. They are outlined under the description of the stream in this report.

Probably the simplest method from a physical standpoint would be to drive a tunnel from Lillooet lake to Stave lake. This would enable the Western Canada Power Company to use the water in their present plant at Stave falls and also in the plant they propose to construct near the mouth of the river. Another plant could be constructed on Stave lake below the outlet of the tunnel to utilize the fall from Lillooet lake to Stave lake, some 100 feet. This plan would give a very efficient means of utilizing the whole fall between Lillooet lake and the Fraser river.

MUNICIPAL WATER SUPPLY.

A number of streams in the Coast division are used for supplying water for various cities and municipalities. Most of these streams are being studied by the British Columbia Hydrographic Survey, and data and information about them are included in this report. For the sake of reference a list is given here:—

Vancouver and many of the surrounding municipalities obtain their supply from Capilano and Seymour creeks, and the water is carried across Burrard inlet at the First and Second Narrows, respectively, through submerged pipes.

North Vancouver is supplied from Lynn creek.

New Westminster has a pipeline from lake Coquitlam. The Vancouver Power Company, during the construction of the dam at the outlet of the lake, built a splendid intake tower and tunnel for the city.

The municipality of Coquitlam is preparing to install a system to draw water from Silver creek which flows into Pitt river from the north near Pitt lake.

The municipality of Maple Ridge has applied for water rights and a reservation of the watershed on the North Lillooet river.

In addition to the places mentioned above, Victoria and a number of other places on Vancouver island have installed water supply systems. It is our intention to continue this work of investigation of water supplies during 1914, with the extension of the work of the survey to include the island.

Where a stream or lake is used to provide a municipal water supply it is often advisable to reserve the entire water basin from settlement, as was done at Coquitlam lake for the New Westminster water supply. In this country

the upper drainage basins are at such high altitudes, and the land is of such mountainous and rocky nature, a reservation does not as a rule interfere with agricultural development, but keeps the water pure and uncontaminated and preserves the natural regimen of the stream.

CONCLUSION.

The foregoing outline of conditions in the Coast division should serve to show how intimately the streams are connected with the life of the province. The prosperity of the country is dependent to a great extent on the flow of the streams, and for many purposes it is necessary that the amount of this flow should be known quite accurately. The flow of each stream varies from day to day, so that continuous records are generally required.

Records of the flow of the more important streams in the Coast division are submitted herewith. It has been the aim to make these results as complete and accurate as possible under the circumstances. In locating the gauging stations, the purpose for which the returns would be used in each case has been kept steadily in mind. It is hoped, therefore, that the results obtained will not be of merely academic interest, but will be of great practical importanc in the development of this part of the province. The inquiries which are beginning to come to the office would indicate that such is the case.

REPORT

OF

BRITISH COLUMBIA HYDROGRAPHIC SURVEY FOR 1913

CHAPTER 3

Kamloops Division

REPORT OF E. M. DANN, D.L.S.

Divisional Engineer

CHAPTER III.

KAMLOOPS DIVISION.

The Kamloops Division is comprised of:—

(1) The Thompson river and all its tributaries.

(2) The Okanagan river and all its tributaries which lie north of the international boundary.

(3) The Fraser river at Lytton, and tributaries of the Fraser between and including Stein creek and the Nahatlatch river.

(4.) That portion of the Skagit river and its tributaries lying within the province of British Columbia.

AREA OF THE KAMLOOPS DIVISION.

The area of the Thompson river catchment basin is some 22,000 square miles.

The area of the Okanagan river catchment basin lying north of the forty-ninth parallel of latitude is about 6,000 square miles.

The area of that portion of the Fraser river drainage which lies within the Kamloops division is about 1,000 square miles.

The area of that portion of the Skagit river which lies north of the forty-ninth parallel is about 400 square miles.

It will readily be seen that this division which comprises roughly an area of 29,000 square miles can be most advantageously directed from Kamloops, where the divisional office is at present located. The division includes the provincial water districts Nos. 2, 3 and 4.

CLIMATE.

The Kamloops division has been outlined arbitrarily by drainage areas. It might almost as logically have been bounded by a 30-inch precipitation contour. With the exception of the upper reaches of the North Thompson, at no point within the Kamloops division does the mean precipitation exceed this amount, and the settled districts lying outside its boundaries where the precipitation is less may readily be enumerated. Speaking in general terms, the Kamloops division covers that portion of British Columbia popularly known as the "dry belt," in which irrigation is practised.

Within this section of country, precipitation varies from a minimum of 5 inches per annum in the vicinity of Ashcroft to a probable maximum of 35 inches near Tête Jaune Cache.

The mean annual precipitation and maximum and minimum temperatures (including snowfall 10 inches—1 inch rain) of several important centres in the district is appended.

Station.	Mean annual precipitation.	Maximum temperature ever recorded. (degree F.).	Minimum temperature ever recorded. (degree F.).
	In.	°	°
Kamloops	10·30	102·4 (1906)	−26·9 (1893)
Nicola lake	11·19	92·5 (1896)	−36·0 (1907)
Okanagan	12·62	96·2 (1908)	−19·4 (1907)
Princeton	13·05	101·0 (1897) (1904)	−45·0 (1907)
Salmon Arm	18·27	101·0 (1906) (1908)	−20·0 (1907)

It may be added that the periods of severe cold are almost always of very short duration, while intense heat is usually felt only after a time of prolonged drought. Within the dry belt, the exceptionally fine weather of the spring and autumn, and the long duration of these seasons, is remarkable.

NATURAL RESOURCES.

MINING.

Mining, except in the older section of the division, is still in its infancy. The principal mine, the largest of its kind in British Columbia, is the Nickel Plate Mine operated by the Hedley Gold Mining Company, at Hedley, B.C.; in the past year it yielded 38,000 ounces of gold, from which $360,000 was paid in dividends. A large stamp mill, a concentrator, a tramway, and other various essentials of this large organization are operated at present by hydro-electric power from Twenty-mile creek. As no material facilities for storage have been obtained, it has been necessary to operate an auxiliary steam plant during the winter months. A dam across the Similkameen river at Hedley is now under construction, and a larger hydro-electric plant is proposed by which the output of the mine may be increased 50 per cent. A head of 67 feet is obtainable in 3 miles, water being conveyed from the headgate to the penstocks in open flumes. It is thought that 1,500 horse-power to 1,700 horse-power may be obtained. The need of records of the flow of the Similkameen river has been felt by the designing engineers.

The coal mines of the Nicola valley come next in importance. These put on the market a variety of bituminous coal known as " Nicola," a good steam fuel, formerly largely used by the Canadian Pacific Railway. The substitution of oil-burning locomotives on certain divisions of the railway has tended to decrease the market for products of the mines. During 1912 the total output of this section was some 230,000 tons.

In the vicinity of Princeton and Tulameen, in the Similkameen valley, coal mines are in operation of which output during 1911 was about 25,000 tons (largely lignite).

Near Kamloops the "Iron Mask Mine," a low-grade copper mine, is in operation, the ore being shipped to a United States smelter.

Several placer gold mines have recently been discovered on Louis and Boulder creeks, north of Kamloops. The production at present is very small, but it is possible that these placer deposits will prove a valuable source of gold, and increase substantially the annual output of the precious metal in British Columbia.

Platinum has been procured in very limited quantities from gold-bearing gravels of the Tulameen river.

Cinnabar (mercury ore) has been discovered in the Kamloops district near Savona.

Gypsum exists in some quantity in the vicinity of Grand Prairie, near Kamloops, and an impure form of this mineral, known as "gypsite," is found near Merritt.

LUMBERING AND UTILIZATION OF WATER.

While the lumber industry is not as important in the Kamloops division as in the more humid sections to the east and west, still lumber companies are in many cases important water users. The Forest Mills, Ltd., have developed water-power of small capacity on Crazy creek at Taft, B.C. (see Water Power Developments).

The Adams River Lumber Company has a control dam on the Adams river, near Chase, B.C., and their rights on this stream may complicate hydro-electric development here. This company also uses water for sluicing from Bear creek, a tributary of Adams river.

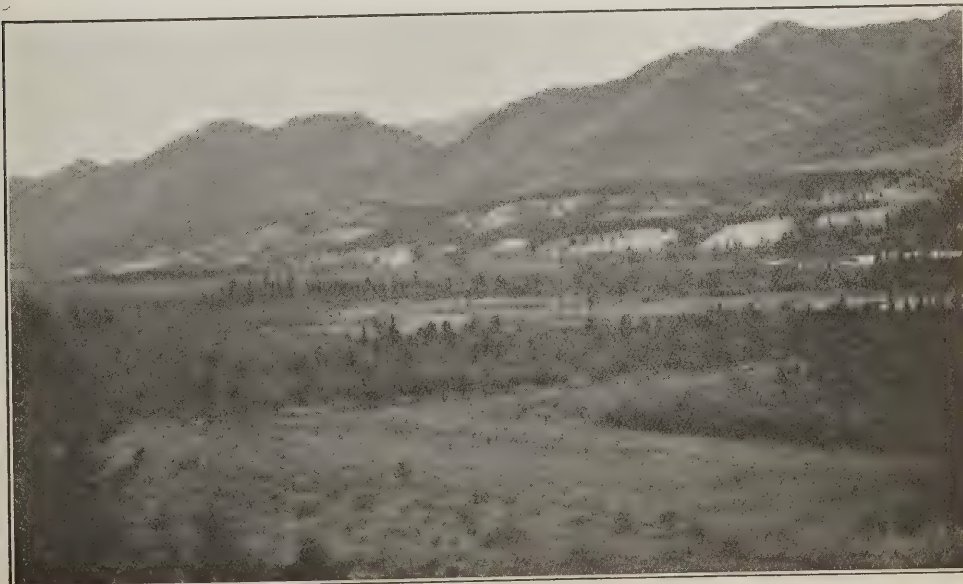
The Arrow Lake Lumber Company diverts the water of Celeste creek, a feeder to Seymour Arm of Shuswap lakes, for sluicing purposes.

The Nicola Valley Pine Lumber Company has constructed a dam of rock-filled timber in Spius creek, which affords impound of about 25 acres.

AGRICULTURAL LAND AND IRRIGATION.

It has been estimated that there are at present some 100,000 acres of irrigable land in Kamloops, Similkameen, Okanagan, Nicola, and Shuswap districts.

While these figures are nothing more than an approximation, it is thought that they are conservative. There are a few sections where dry farming and the scientific rotation of crops is practised, and a few, where the rainfall is adequate, simple farming is carried on; but in the main, irrigation is essential for successful



Upper Columbia Valley Bottom Lands near Wilmer B.C.

farming, and year by year the old-fashioned methods are being superseded by the product of modern ideas. Where formerly the open gravel ditches or flumes of rough timber were seen paying their toll for inefficiency through leakage, seepage, and evaporation, one now sees the concrete lined and covered-in canals and the carefully constructed metal flumes. This applies at present, of course, only to the larger land companies whose initial capital has permitted the more expensive and efficient construction to be undertaken, but even the small farmer is paying more attention to this subject than heretofore.

Upper Columbia Valley Bottom Lands, near Wilmer, B.C.

Irrigation is at present carried on almost entirely by gravity methods, but the pumping of water from the larger rivers to the bottom and bench lands will open up a large field for future development.

A scientific study of pumping, including efficiency of various types of pumps, prime movers, and fuels is very advisable at the present time, as it will be the means of preventing costly mistakes on the part of those ranchers progressive enough to adopt this method of reclaiming arid land. As this question might well be considered in the jurisdiction of the British Columbia Hydrographic Survey, it is recommended that steps be taken in this connection during the coming season.

Fruit growing is the predominant pursuit in the Okanagan and portions of the Similkameen valleys, while mixed farming is carried on in the Kamloops, Nicola, and Shuswap sections. Stock raising is gone in for to a great extent, particularly in the vicinity of Kamloops, Ashcroft, and Merritt, where the ranges are eminently suited to this industry. Alfalfa is grown extensively in these sections for winter feeding.

The names of some of the larger irrigation companies in the Kamloops division which have constructed extensive irrigation works are appended: White River Valley Power Co. (Vernon), British Columbia Fruitlands (Kamloops), British Columbia Horticultural Estates (Walhachin), Barnes Estates (Walhachin), Summerland Development Co. (Summerland), Southern Okanagan Land Co. (Penticton), Belgo Canadian Land Co. (Kelowna), South Okanagan Land and Orchard Co. (Kelowna), Kelowna Irrigation Co. (Kelowna).

MUNICIPAL WATER SUPPLY.

The question of municipal water supply, which is a momentous problem in the more thickly populated districts of the world, while not yet so urgent or important in British Columbia owing to the physical features of this province, still it is a matter which, for the sake of the future, must receive intelligent thought.

Kamloops, the largest town in the dry belt, gets its water supply from the South Thompson river; Vernon, Kelowna, Salmon Arm, and Penticton, from adjacent mountain streams; Ashcroft from the Bonaparte river.

Sewage disposal is a matter which is intimately related to the question of water supply, especially in towns situated on the larger rivers. It is now considered an axiom that no practical method of sewage purification will entirely eliminate disease-producing germs, although modern methods will materially reduce them. Any city which derives its water supply from a river or stream into which other cities or communities discharge their sewage, whether treated or raw, will generally find it necessary to purify the stream's water before it may be safely used for domestic purposes.

While a study of velocity and discharge is necessary on streams from which a water supply is derived, and which act as a medium for the disposal of sewage, it is on the smaller streams that hydrographic work is of most importance. Since conditions do not always permit of the impounding of surplus run-off in reservoirs, the minimum discharge of any stream which is a source of water supply is of particular interest. An average city or town consumes 100 gallons of water per day per capita. This is considered to be a liberal estimate and is arrived at by taking the mean of various quantities used in numbers of cities and towns throughout the States United and Canada, in which countries, by the way, the wanton waste of water is notorious. (Johnston--"Purification of Public Water Supplies".)

WATER-POWER DEVELOPMENTS.

CITY OF KAMLOOPS PLANT ON BARRIÈRE RIVER.

The principal hydro-electric development in the Kamloops division is the city of Kamloops municipal plant of the Barrière river, for which Messrs. Ducane and Dutcher, of Vancouver, are designing and constructing engineers. Since 1911, records of flow have been obtained showing a maximum of 3,300 second-feet, and a low-water flow of 150 second-feet.

The plant will operate under a head of 196 feet, water being carried by 17,800 feet of flume line to the penstocks. Good storage facilities are afforded, and no serious interference from frazil or anchor ice is anticipated.

The initial capacity of the plant will be 1600 to 2000 horse-power and provision is being made for its ultimate extension to 10,000 horse-power. The cost of this initial undertaking is estimated at $237,600. The ultimate development will probably increase the cost by $250,000 to $300,000. Power will be generated at 2200 volts 3 phase, 60 cycles, being stepped up to 44,000 volts for transmission. Step-down transformers, switchboard, etc., will be located at the auxiliary steam plant power-house at Kamloops.

Two 1200-horsepower Francis type turbines are to be used for the initial development, each designed for direct connection. The flume line is of timber construction but will probably be replaced by metal flume or concrete-lined canal for the ultimate development. The forebay and power-house are of concrete construction. 15-foot timber dam of rock-filled cribbing is designed for the flume's intake.

OTHER SMALL DEVELOPMENTS.

The town of Spence's Bridge receives light and power from Murray creek, where a small development of 100 horse-power has been made. A Pelton wheel operating under a 220-foot head is used, 16-inch rivetted steel pipe conveying water to the wheel, the upper 175 feet of pipe being laid in rock tunnel.

Forest Mills, Limited, of Taft, B.C., has a Pelton wheel development of 160 horse-power operating under a head of 175 feet. Power is used for the saw-mill and for lighting the town of Taft.

The development of the Hedley Gold Mining Company on Twenty-mile creek in the Similkameen valley, is a Pelton wheel development, the power being used for operating the company's forty-stamp mill and concentrator, as well as for electric tramway and cable cars.

A small hydro-electric plant on the Bonaparte river, from which power has been used for the town of Ashcroft, is at present out of commission owing to the failure of the dam during the freshet of 1913. It is understood that the dam may not be replaced, in which case the town will continue to derive its power from its auxiliary steam plant.

FUTURE DEVELOPMENTS.

The Coteau Power Co., controlled by Mackenzie and Mann interests, propose an extensive development at Coteau Falls on the Shuswap river near Lumby, B.C. Nine thousand horse-power will be the capacity of the plant which, if constructed, may be used for the electrification of the Okanagan branch of the C.N.R.

The Hedley Gold Mining Company propose a development of 1500 horse-power on the Similkameen river at Hedley (see "Mining"). Construction will probably be carried on during 1914.

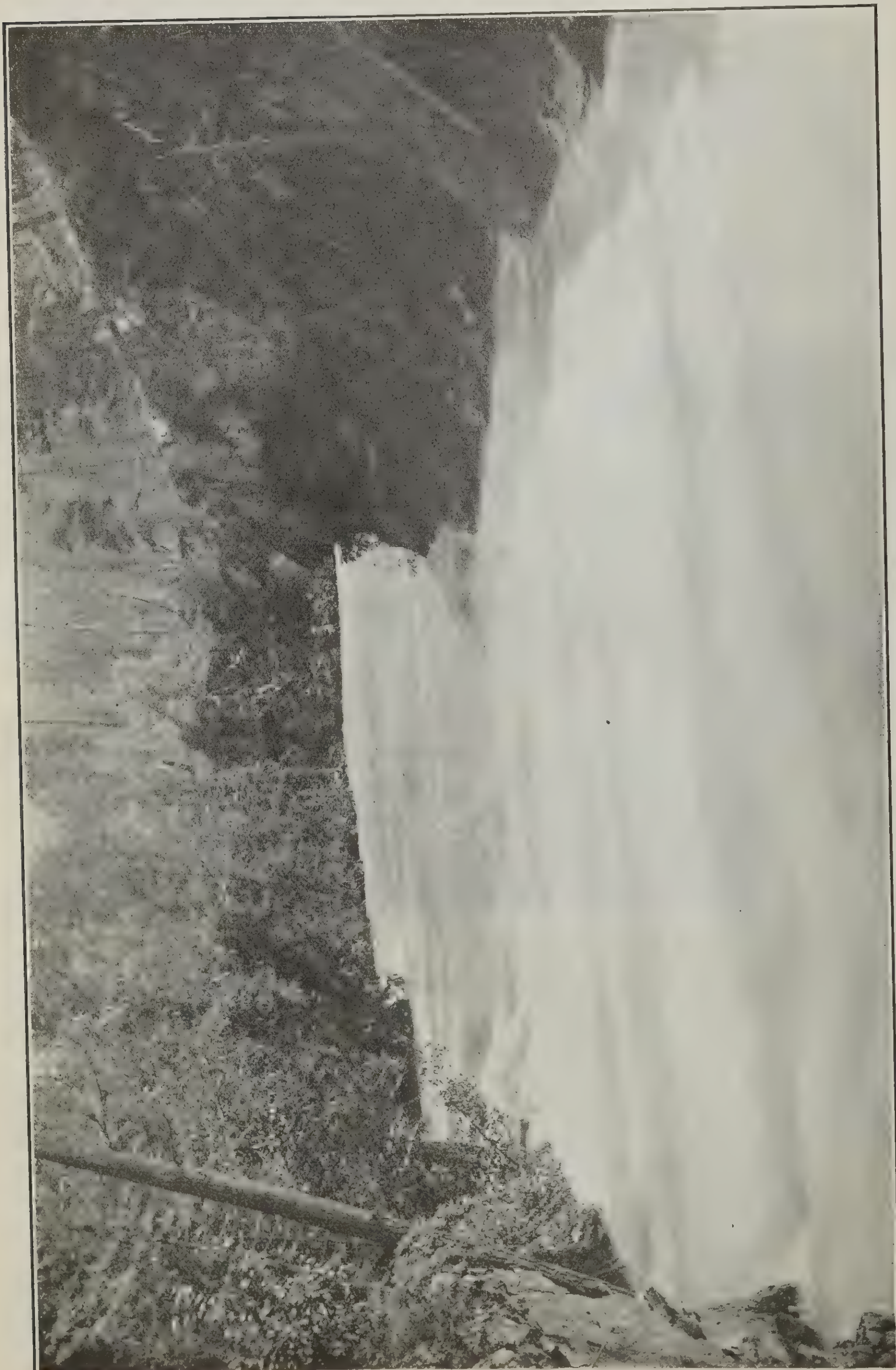
Myrtle River—Helmcken Falls clear drop of 450 feet.

The most important undeveloped sources of power in this district are: The Adams river near Chase, where a head of 200 feet in 6 miles, with a probable mean discharge of 1200 second-feet could be obtained. Adams lake forms an excellent storage basin, and no very important interests would be affected by damming its outlet.

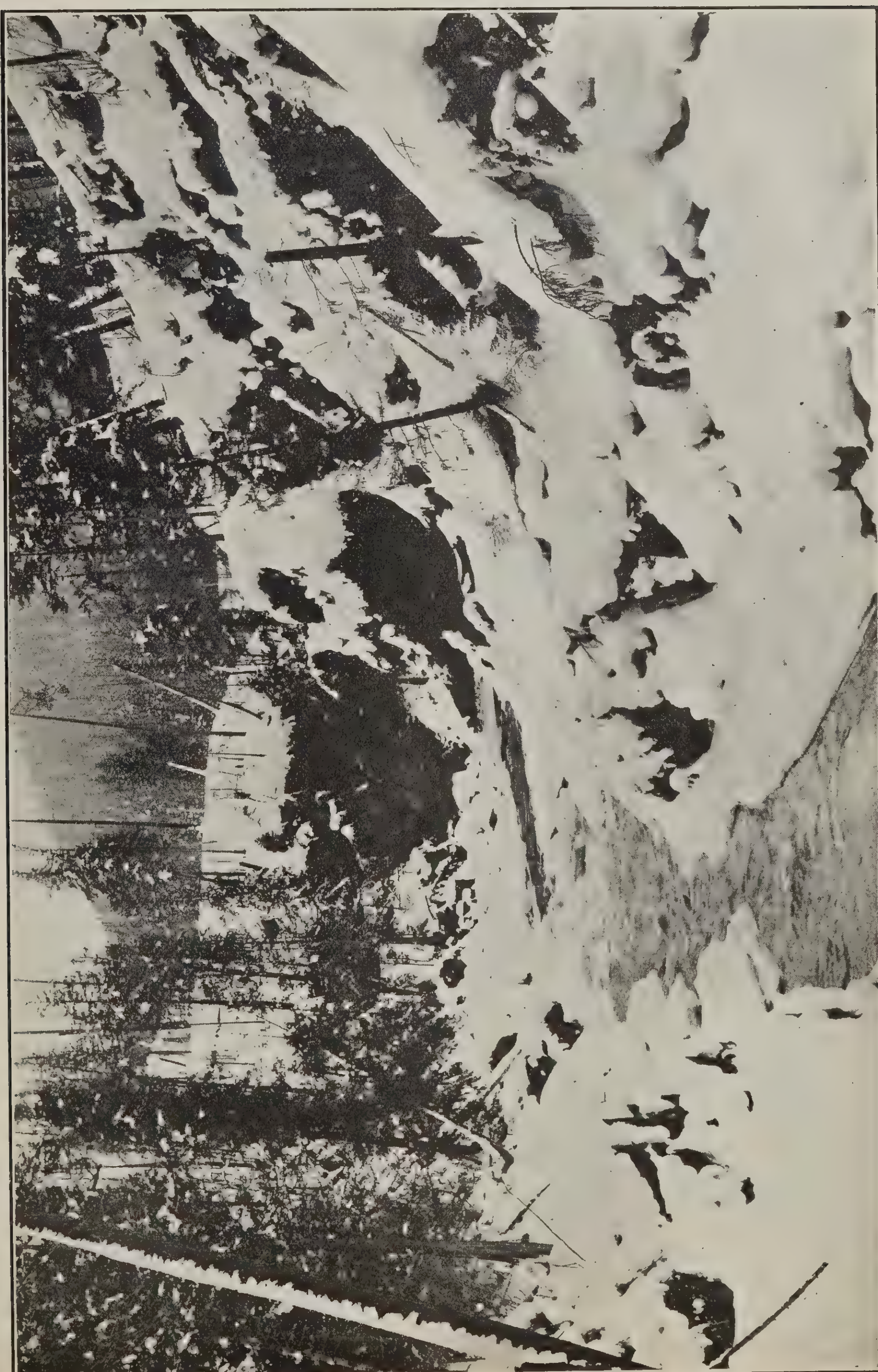
The Clearwater river has falls of considerable size, while on its main tributary, Myrtle creek, there is one sheer fall of 450 feet. Excellent storage is also said to be available. As yet no accurate data in regard to these powers are available, but it is our intention to begin the collection of information on these important streams during the coming season.

The Seymour river and Celeste creek in the Shuswap Lake drainage area, are important sources of water-power, while many smaller mountains stream will no doubt soon be utilized to supply the needs of progressive communities.

Barrière River—Intake Dam—City of Kamloops Development.



Shuswap River—Coteau Hydro-Electric Company's Development Dam Site.



Shuswap River—Coteau Hydro-Electric Company's Development Dam Site.

REPORT

OF

BRITISH COLUMBIA HYDROGRAPHIC SURVEY FOR 1913

CHAPTER 4

Kootenay-boundary Division

REPORT OF C. E. RICHARDSON, A.M. CAN. SOC. C.E.

Divisional Engineer

CHAPTER IV.

KOOTENAY BOUNDARY DIVISION.

GENERAL.

Kootenay Boundary division is that part of British Columbia known as East and West Kootenay districts and that part of Yale district which is drained by Kettle river (generally known as the Boundary district) or it might be described as comprising the whole drainage area of the Columbia river except the Okanagan river basin. The East and West Kootenays are divided by the Selkirk range, and these are encompassed on the north, south, east, and west by Columbia river and its tributary, the Kootenay.

The Columbia rises in Columbia and Windermere lakes, 90 miles south of the C.P.R. main line at Golden, and flows in a northwesterly direction for about 200 miles at the Big Bend, at which point it turns and runs southerly for about 250 miles, past Revelstoke, through Arrow Lakes, crossing the international boundary line at Waneta, B.C.

The Kootenay river rises in Beaverfoot range of the Rocky mountains about 20 miles south of the C.P.R. main line at Palliser, B.C., and flows for 175 miles in a southerly direction, passing within 1 mile of Columbia lake, and crossing the international boundary line at Gateway, B.C. It flows through Montana, into Idaho, re-entering British Columbia 60 miles west of Gateway and 20 miles south of Kootenay Landing, at which point it loses itself in Kootenay lake. From Kootenay lake, the river flows in a southwesterly direction, discharging into Columbia river at Castlegar, about 20 miles north of the international boundary line.

AREA AND DRAINAGES.

The total area of Kootenay Boundary division is approximately 32,000 square miles. Of this, some 15,000 square miles are drained by the Columbia above the mouth of Kootenay river. The Kootenay drains approximately 13,000 square miles in British Columbia. The boundary district comprises an area of about 3,000 square miles, drained by Kettle river. The remaining 1,000 square miles are drained by Pend d'Oreille river, of which Flathead creek is a tributary; Pend d'Oreille river discharges into the Columbia at Waneta, 200 yards north of the international boundary line.

CLIMATIC CONDITIONS.

A great variation in climatic conditions exists in the different sections of the Kootenay Boundary division. In part of southeast Kootenay and the Boundary the total precipitation is small, varying from 10 to 18 inches, and is similar to other semi-arid districts in British Columbia, where the summers are hot and dry, and the winters severe (–40°F.) with only a light snowfall.

In southwest Kootenay the summers are hot but the rainfall fairly heavy, average for May to September, 1908-12, being slightly over 10 inches at Nelson. During the winters the thermometer seldom goes below zero, and the larger rivers never freeze over. The precipitation is heavy, the snowfall in certain districts being about 6 feet. In the north half of both East and West Kootenays the summers are hot and the rainfall is fairly heavy (about the same as Nelson). The winters are severe (–50°F.) with heavy snowfall. At Glacier, on the C.P.R. main line, the snowfall varies from 40 to 50 feet each season.

RUN-OFF.

It would be a difficult matter to obtain a reliable factor to relate the run-off in surface waters with the precipitation, for it would necessitate a study for a series of consecutive years. All the larger and more important streams are glacial fed. Extreme high water in the summer is obtained in all probability through a combination of heavy snowfall during the preceding winter, with a series of hot days and nights in May and June and possibly July and August; warm rains also greatly increase the flow. At the same time it appears possible that very high water may be obtained by a series of hot days and nights when the precipitation has, apparently, not been very heavy during the preceding winter; this is particularly noticeable in the smaller drainages.

A more or less interesting comparison relating to the run-off on the east and west slopes of the Selkirks and the west slope of the Rockies in the vicinity of Revelstoke and Golden during the months May to September, 1913, is made herein. The streams considered are as follows:—

(1) West slope of the Selkirks—Illecillewaet, Akolkolex, and Incomappleux rivers.

(2) East slope of the Selkirks—Beaver and Spillimacheen rivers.

(3) East slope of the Rockies—Blaeberry and Kicking Horse rivers.

Locality.	Drainage area in Square Miles.	Run-off Depth in inches.
1. West slope of the Selkirks	1,045	62
2. East " "	980	39
3. West " " Rockies	1,025	26

Probably 80 per cent of the run-off of the above-mentioned drainages is included in the months May to September. With the exception of Akolkolex river the streams are all about the same length—30 to 40 miles. The streams in localities (1) and (2) have their source in the same vicinity, i.e., Glacier National park. The streams on the west slopes of the Selkirks and Rockies (1) and (3) all flow in a southwesterly direction, while the Spillimacheen flows south-east and the Beaver northeast. The drainage areas of each individual stream (taken from Railway Belt maps) are not, perhaps, very accurate, but by taking the streams in groups the error is diminished. The figures above should show, within 15 per cent, the relative run-off on the three slopes in the localities above mentioned.

The work in the southern part of the division has just been started, and only investigations on the most important streams have been carried on. Comparisons of the Columbia river above the mouth of the Kootenay river, and the Kootenay river at the mouth and Pend d'Oreille river are as follows:—

Stream.	Drainage Area. in square miles	Run-off depth in inches. June to December, 1913.
Columbia, above the mouth of the Kootenay	15,000	36·1
Kootenay at mouth	19,000	22·1
Pend d'Oreille at mouth	26,600	12·5

The drainage of the Columbia river above the mouth of the Kootenay includes all the northern part of East and West Kootenays. The drainage of

Kootenay river includes the southern part of East and West Kootenays and a portion of northern Idaho and Montana. The drainage of the Pend d'Oreille includes areas in northeast Washington, southwest British Columbia, northern Idaho and northwestern Montana.

The above table shows in a marked manner the increase in run-off from the southern to the northern end of the division.

UTILIZATION OF WATER.

In dealing with the utilization of water the following divisions may be made:—

Mining.
Timber.
Irrigation.
Domestic and Municipal.
Hydro-electric Development.

MINING.

The following table shows the production of metals, coal, and coke in the Kootenay Boundary district of British Columbia for the year 1913:—

	Tons.	Value.
		$
Consolidated M. & S. Co.	335,323	6,846,309
Granby M. S. & P. Co.	1,242,053	4,486,830
British Columbia Copper Co.	622,442	1,887,394
Hedley Gold mines	70,727	792,330
Other stamp mills	53,488	548,199
Zinc shipments	9,017	494,452
Tonnage other ores milled, not included in above	240,300	
Total metalliferous	2,573,350	15,055,514
Less United States ores	73,250	829,938
Total British Columbia metalliferous	2,500,100	14,125,576
Less miscellaneous British Columbia ores	835	41,367
Kootenay and Boundary, metalliferous	2,499,265	14,084,209
Total coal sold	1,581,449	4,842,028
Total coal used for coke	492,902	1,713,178
Total value metalliferous coal and coke	4,573,616	20,639,415

Coke produced: 319,325 short tons at $5.36½ per ton.

In the above figures December is estimated in all cases.

In the operation of practically all mines the use of water is essential. The importance of water-power developments in connection with the operation of mines is shown in the table below. Between twenty and thirty small powers ranging from 50 to 750 horse-power are here shown, but it is regretted that this list is not complete; probably from six to ten more developments should be added. Aside from these small developments the majority of ore is mined by power procured from the West Kootenay Light and Power Company. After the ore is mined and shipped to the smelters, water and water-power again become an important factor; the three smelters in the Kootenay Boundary division using about 10,000 horse-power. The production in tons in the following list was

obtained through the courtesy of the Nelson *Daily News*. The accuracy of the horse-power developed is not guaranteed, there being a great variation in most cases, according to the season and the amount of power required.

Mine.	Locality.	1913. Production.	Horse-Power.	Remarks.
East Kootenay.				
Sullivan	Kimberly	35,925	350	Power from Mark creek, Silver-lead mine.
Monarch	Field	196	100	Power from Cathedral creek, Silver-lead mine.
Miscellaneous		1,782		
Total		37,683		
Boundary District.				
Granby Co	Phoenix	1,242,053		All mines are copper mines unless otherwise designated. Power is supplied to the Granby mines at Phoenix by the West Kootenay Power & Light Co.
Motherlode	Deadwood	303,996		Power is supplied by the West Kootenay Power & Light Co.
Rawhide	Phoenix	238,455		Power is supplied by the West Kootenay Power & Light Co.
Miscellaneous		14,472		
		1,798,976		
West Kootenay.				Except where otherwise mentioned, the ore production in West Kootenay is silver-lead.
Slocan District.[1]				
Standard	Silverton	14,967	650	Power from Four-mile creek.
Van Roi	"	627	540	Power from Granite creek.
Hewitt	"	231	325	Power from Four-mile creek.
Idaho-Alamo	Three Forks	276		Power from Carpenter creek, now in disuse.
Ruth	Sandon	471	150	Power from south fork of Carpenter creek.
Slocan Star	"	562	75	Power from Sandon and White creeks, tributaries to south fork of Carpenter creek.
Noble Five	"	53	300	Power from south fork of Carpenter creek.
Wonderful	"	50	140	Power from Tributary and Miller creeks, tributaries to south fork of Carpenter creek
Ivanhoe	"	37	275	Power from south fork of Carpenter creek.
Monitor-Ajax	Roseberry		150	Power from east fork of Wilson creek.
Payne	Sandon		300	Power from Payne and Reciprocity creeks.
Enterprise	Slocan		150	Power from Ten-mile creek.
Last Chance	Sandon		50	Power from Last Chance Slide creek.
Miscellaneous		6,105		
Total		23,379		

[1] Power used in Slocan District obtained through courtesy of W. J. E. Biker, District Engineer, Water Rights Branch, Nelson, B.C.

Mine.	Locality.	1913. Production.	Horse-Power.	Remarks.
West Kootenay—*Concluded.*				
(b) *Rossland District.*				
Centre Star	Rossland	156,441	....	Power is supplied to all mines at Rossland by the West Kootenay Power & Light Co.
Le Roi	"	63,039	....	Q.v. under hydro-electric developments.
Le Roi No. 2	"	20,515		
Le Roi No. 2 Concentrate	"	1,985		
Miscellaneous		694		
Total		242,694		
(c) *Nelson District.*				
Ymir-Wilcox	Ymir	....	40	Avalanche rapids.
Yankee Girl	"	2,034	150	This plant is now being installed. Water is taken from Wild Horse creek.
Arlington	Erie	400	....	
Motherlode	Sheep creek	24,728	600	Power from Sheep creek, Motherlode is a gold mine.
Nugget	"	....	....	Now amalgamated with Motherlode mine.
Molly Gibson	Nelson	950	200	Power from Kokanee creek.
Silver King	"	3,881	....	Power from West Kootenay Light & Power Co.
Queen Victoria	"	22,795	....	Power from the West Kootenay Light & Power Co. Copper mine.
Granite-Poorman	"	90	....	Power from the City of Nelson Light & Power Co.
Dundee	Ymir	....	200	Power from Beaver creek; 300-foot head.
Second Relief Mill	Salmo	4,870	250	Power from North Fork of Salmon river; 260-foot head.
Miscellaneous		32,059		
Total		86,396		
(d) *Ainsworth District.*				
Bluebell	Riondel	7,208	250	Power from Indian creek. Head about 750 feet.
Silver Hoard	Ainsworth	1,286	125	Development now being installed, water from Cedar creek.
No. 1	"	3,929	500	Power from Cedar creek, Development now being installed.
Highland	"	1,129		
Maestro	"	157		
Utica	Kaslo	628	200	Power from Twelve-mile creek, tributary to Kaslo river.
Whitewater	Whitewater	517	200	Power from Whitewater creek, tributary to Kaslo river.
Miscellaneous		48		
Total		14,902		

Smelters.	Locality.	1913. Tons Treated.	Horse-Power.	Remarks.
Consolidated	Trail	335,323	3,000	West Kootenay Light & Power Co.
Granby	Grand Forks	1,242,053	3,500	West Kootenay Light & Power Co.
			700	Development immediately above Smelter on north fork of Kettle river.
B. C. Copper	Greenwood	622,442	2,000	West Kootenay Light & Power Co.

TIMBER.

Among the great industries of Kootenay and Boundary districts is the lumber manufacturing business, the timber being logged from the great tracts of timber which cover the mountains of the vicinity. Many millions of dollars are invested in the timber limits and mills, and the amount of money expended annually in labour and supplies reaches a huge figure. In the mountain district of British Columbia there are in the neighbourhood of one hundred mills of various sizes, and the majority of these are in southeastern British Columbia.

The lumber industry in this district has been largely dependent upon the demand from the prairies, but this year some of the mills of the interior of the province claim that they will find a market in the United States, on account of the reduction in the duty which became effective with the passage of the new Tariff Bill. During 1913 market conditions in the Prairie Provinces were not particularly good, yet in spite of this fact it is estimated from the official figures of the amount shipped out that the value of the lumber exceeded $8,000,000. Low stocks in prairie lumber yards at the present time, together with last season's good crops, are pointed to as indicating an improved market during the coming year.

Lumber companies, which are scattered throughout the whole division, use the numerous streams for log-driving during the freshet in May, June, July, and August. In Boundary district on Kettle river the drive in 1913 amounted to 20,000,000 feet.

IRRIGATION LANDS.

The scarcity of agricultural lands and the richness of the soil necessitates the utilization of all available lands in an attempt to fulfil the demands of the local markets. With the exception of small plots here and there, the valleys of Columbia, Kootenay, and Kettle rivers afford the only location of agricultural lands. The two most important and largest farming localities are "Windermere-Cranbrook" and Grand Forks districts. In the first case, large benches along Columbia and Kootenay rivers have attracted many settlers, and large companies are now developing 10,000 to 20,000-acre tracts which would be of little value to the individual farmer on account of the prohibitive cost of installing an irrigation system. Grand Forks district is well known for its orchards, and the land generally brings a high price per acre. In the vicinity of Nelson and along Lower Arrow lake, large tracts of land have recently been cleared, and appearances tend to show that both fruit growing and mixed farming may be successfully carried on in these localities.

Irrigation is required in both Grand Forks and Windermere-Cranbrook districts. In the latter district the gravity system only is in use. The Columbia Valley Orchards are installing an extensive irrigation system, including about

20 miles of flume, and are obtaining water from the Vermilion river and Sinclair creek. The Columbia Valley Irrigated Fruit Lands Company at Invermere are also installing a large system by which they obtain water from Dutch, Toby, and Horsethief creeks. These two companies expect to irrigate about 100,000 acres of land. In Grand Forks district, pumping from Kettle river is used extensively. Power is supplied chiefly by the West Kootenay Light & Power Company. Very little irrigation is required in any other part of this division.

DOMESTIC AND MUNICIPAL.

The numerous small streams; particularly in East and West Kootenays, make it a simple matter for the settler to have his own pipeline and water supply. In the same way only a few villages should have difficulty in obtaining a suitable supply. It is hoped that this survey will be able to publish information which will assist in the installation of adequate water systems where such have not already been installed.

The following towns are lighted by hydro-electric developments: Revelstoke, Glacier, Nelson, Trail, Rossland, Grand Forks, Phoenix, Greenwood, Eholt, New Denver, Silverton, and Kaslo.

HYDRO-ELECTRIC DEVELOFMENTS.

The "Utilization of Water" has already been discussed under the four headings referring to "Mining," "Timber," "Irrigation," and "Municipal and Domestic," and in three of these headings hydro-electric developments have been mentioned. Practically every water plant for mining purposes is used to some degree as a hydro-electric development. Pumping by hydro-electric power for irrigation purposes is used in Grand Forks district, and some ten towns in this division are lighted by hydro-electric developments.

By far the most important development is that of the West Kootenay Light and Power Company, situated at Upper Bonnington falls on Kootenay river, 11 miles from Nelson. This plant is operating under a 64-foot head. Two 8,000-horse-power units are in operation, and a third unit of 10,000 horse-power is now being installed. The capacity of the plant is 36,000 horse-power and it was designed to use 3-runner turbines. Power is supplied to mines in Nelson, Rossland, and Boundary districts, to the smelters at Trail, Grand Forks and Greenwood, to light the towns of Rossland, Trail, Eholt, Grand Forks, and Phoenix, and for pumping for irrigation purposes in Grand Forks district.

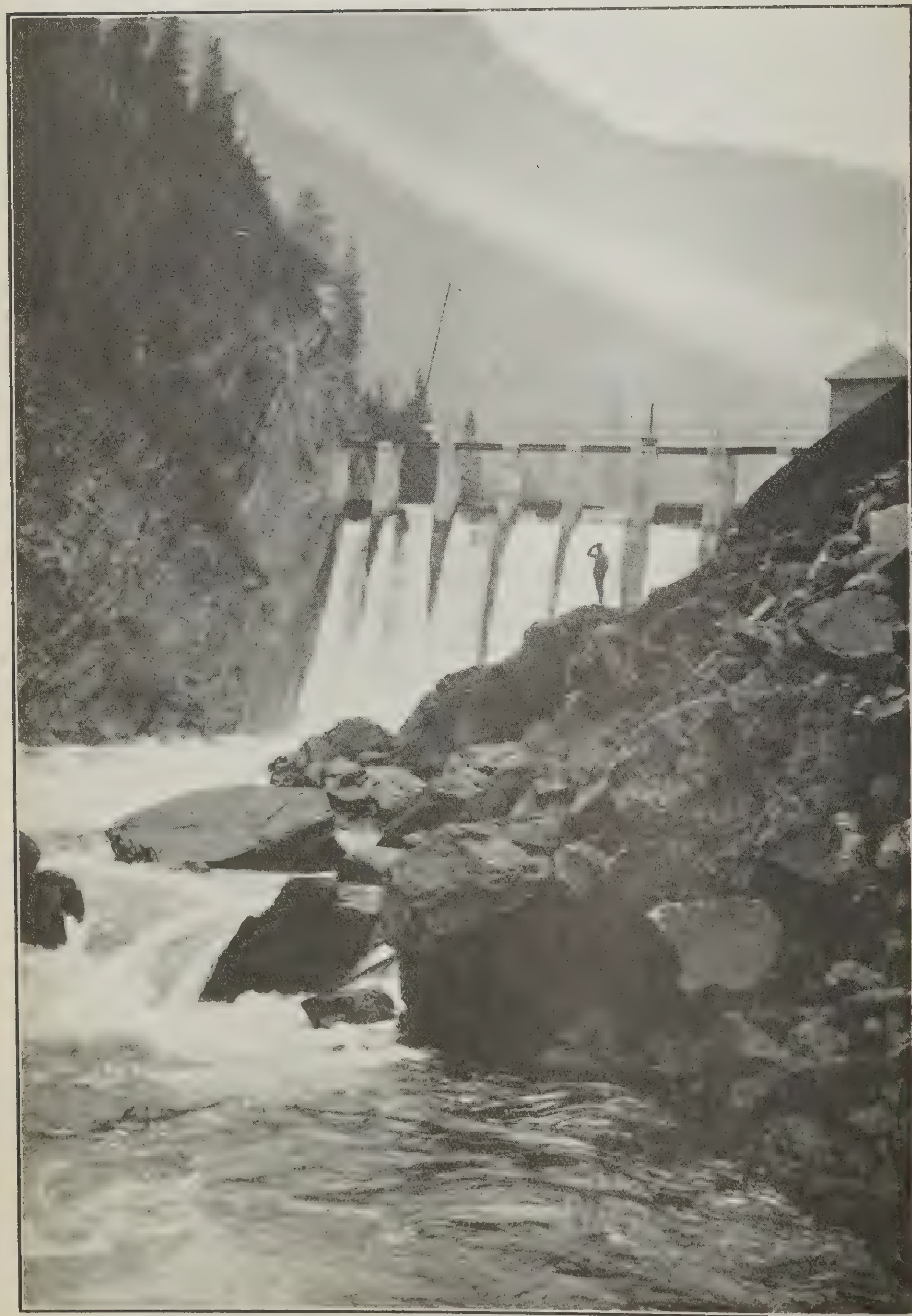
The West Kootenay Power and Light Company has two auxiliary plants, one at Lower Bonnington falls on Kootenay river, 12 miles from Nelson, and one on Kettle river at Cascade.

The plant at Lower Bonnington falls has a capacity of 4,000 horse-power, and operates under a head of about 40 feet.

At Cascade the plant is operated under a head of 155 feet, and the development exceeds 5,000 horse-power.

The City of Nelson Light and Power plant is situated at Upper Bonnington falls on the opposite shore to the West Kootenay Light and Power Company's plant. It is operated under a 60-foot head, and at present generates 1,250 k.w., the power is used to light the city of Nelson, to operate the city street railway, for manufacturing purposes in Nelson, and to operate one or two mines in the vicinty of Nelson.

On the north fork of Kettle river the Granby Mining, Smelting and Power Company have a small development. This plant is operated under a head of 30 feet, and supplies light and a small portion of the power used in the smelter; 700 horse-power is generated.



Illecillewaet River—Revelstoke Light and Power Company's Dam.

Greenwood City Power and Light plant is located at Boundary falls on Boundary creek. The plant is operated under a head of 130 feet, and supplies light to the city of Greenwood. Capacity 250 horse-power.

The City of Revelstoke Power and Light plant is located on Illecillewaet river about 2 miles from Revelstoke. A concrete dam has been built, and water is carried to the power-house, some 200 yards below, through a 6-foot stave pipe. The present plant is in duplicate on a 450 k.w. capacity basis.

The C.P.R. have a small installation on the Illecillewaet near Glacier the power generated being used for lighting their hotel at that point from May to October. The plant is operated under a head of 60 feet and about 100 horse-power. (12-hour power) is obtained. A concrete dam 15 feet high and 100 feet long affords a small storage, and to increase the flow in the early morning water is diverted from Asulkan brook.

New Denver, Silverton, and Kaslo have small developments for lighting purposes on Carpenter creek, Four-mile creek, and Kaslo river, respectively.

As the country progresses the demand for power increases, and it is expected that during the coming year several more plants of from 5,000 to 10,000 horse-power will be installed in this division.

HYDROGRAPHIC DATA.

GENERAL CHARACTERISTICS, 1913.

Throughout Kootenay-Boundary division in 1913 very high water existed. The snowfall during the winter 1912-13 was heavy, and for the first two weeks in June the days and nights were hot throughout practically the entire division. Columbia river below Arrow lakes became abnormally high and great damage was threatened; however, on the 15th of June cool weather set in throughout the Kootenay drainage area and continued for a sufficient length of time to check extreme high water. Nevertheless, two washouts occurred on the Great Northern between Waneta and Marcus along the Columbia. The Kootenay at Nelson registered about 8 feet higher than in 1912, and the water was up to the base of the C.P.R. rail at a point between Nelson and Granite. The streams in the northern half of East and West Kootenays aggregated a flow 20 per cent greater than the 1912 discharges.

RÉSUMÉ OF PROPOSED WORK FOR 1914.

Up to the present there has not been sufficient money available to investigate ice conditions, for which reason very little information is available as to minimum flow and winter discharges on the streams in East Kootenay, the northern part of West Kootenay, and the Boundary. It is proposed during the winter of 1914-15 to thoroughly investigate the behaviour of those streams on which there are power possibilities. Among those streams will be: Columbia at Revelstoke, Donald and Golden, Kicking Horse, Blaeberry, Toby, Horsethief, No. 2 Bugaboo, Spillimacheen, Beaver, Illecillewaet, Jordon, Akolkolex, Incomappleux, Kettle, Elk, Bull, and St. Marys. It is hoped that by May, 1914, to have stations established and to have systematic gaugings on sixty of the most important streams in Kootenay-Boundary division.

REPORT

OF

BRITISH COLUMBIA HYDROGRAPHIC SURVEY FOR 1913

CHAPTER 5

Coast Division—Hydrographic Data

CHAPTER V.

COAST DIVISION—HYDROGRAPHIC DATA.

REGULAR METERING STATION.

BELKNAP CREEK AT BELKNAP LAKE.

Location—Section 36, township 6, range 7, west of the 7th meridian.

Records Available—Continuous records since October 21, 1912.

Winter Conditions—Very heavy snowfall but practically no ice on the stream. Open water conditions all year.

Gauges—Staff gauge near outlet of lake—readings irregular, one or two per week.

Channel—Bed of stream strewn with rocks and boulders, giving uneven bottom but good control.

Discharge Measurements—One measurement in 1912 and six in 1913, well distributed— measurements made from cable carrier.

Accuracy—Good meter measurements, but gauge readings not regular, one or two per week.

BELKNAP CREEK.

Belknap creek rises at the foot of mount Ida, at an elevation of some 3000 feet, and discharges into Hixon creek below Belknap lake at an elevation of about 1500 feet. It is part of Burrard Inlet drainage. It would be very difficult to attempt to estimate the drainage area of the stream from the data at present available.

The precipitation in the Belknap creek watershed is probably between 120 and 150 inches per annum. There is very heavy snowfall in the winter, but the weather is not cold, and very little ice forms on the streams.

There are two important lakes on the creek; Ann lake, at an elevation of 2200 feet, has an area of 83 acres; Belknap lake, at an elevation of 1800 feet, has an area of 15 acres.

The Westminster Power Company proposes to include Belknap creek in the high head development. The latest proposal is to divert water from some point between Ann and Belknap lakes, and carry it by means of a short flume and pipeline into Norton lake, which is to be used as the main equalizing reservoir.

There are two gauging stations on Belknap creek. Up to the present the station at the lower end of Belknap lake is the one which has been most used. In 1913, however, a second station was established below Ann lake near the proposed site for the diversion to Norton lake. Meter measurements have been taken at this station, but no regular gauge readings.

DISCHARGE MEASUREMENTS of Belknap Creek at Belknap Lake, 1912-13.

Date.	Hydrographer.	Meter No.	Width.	Area of Section	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Oct. 21, 1912.	C. G. Cline....................	1,C46	33·0	50·8	0·66	1·60	33·7
June 4, 1913.	H. C. Hughes..................	1,673	35·0	101·3	2·66	3·20	257·0
" 11, 1913.	do	1,673	34·0	85·4	1·82	2·70	148·0
" 25, 1913.	do	1,673	33·5	87·6	1·76	2·65	147·0
July 22, 1913.	do	1,673	36·0	106·3	1·98	2·92	202·0
" 31, 1913.	do	1,673	35·0	73·7	1·02	2·02	75·0
Sept. 22 1913.	F. MacLachlan................	1,673	35·0	50·3	0·85	1·55	40·9

MONTHLY DISCHARGE of Belknap Creek at Belknap Lake for 1913.

Month.	Discharge in Second-Feet.			Run-off.
	Maximum.	Minimum.	Mean.	Total in acre-feet.
January	8	8	8	491
February	33	8	14	777
March	11	9	11	676
April	65	9	38	2,260
May	202	25	82	5,040
June	255	155	174	10,400
July	192	93	137	8,420
August	87	33	54	3,320
September	93	25	54	3,210
October	409	15	81	4,980
November	61	25	40	2,380
December	41	21	33	2,030
The year	409	8	60·5	43,984

NOTE.—Accuracy "B" and "C".

MONTHLY DISCHARGE of Belknap Creek below Belknap Lake for 1912.

Month.	Discharge in Second-Feet.			Run-off.
	Maximum.	Minimum.	Mean.	Total in acre-feet.
November	65	15	48	2,860
December	27	8	14	860

NOTE.—Accuracy "B" and "C".

DAILY GAUGE HEIGHTS AND DISCHARGES, Belknap Creek below Belknap for 1912.

Day.	October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1				51		13
2				52		12
3				53		11
4				54		10
5				55		9
6				56	0·7	8
7				57		10
8				58		12
9				59		14
10				60		16
11				61		18
12				62		20
13				63		22
14				64		24
15				65		26
16			1·9	65	1·4	27
17				61		24
18				57		21
19				53		18
20				49		15
21	1·6	41		45		12
22		41		41		10
23		42		37	0·7	8
24		43		33		8
25		44		29		8
26		45		25		8
27		46		23		8
28		47		20		8
29		48	1·2	17		8
30		49		15		8
31		50				8

DAILY GAUGE HEIGHTS AND DISCHARGES of Belknap Creek near Belknap Lake for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	0·7	8	0·7	8		11		11		35		215
2		8		8		11		11		30		228
3		8		8		11		10	1·35	25		241
4		8		8		11		10		33	3·2	255
5		8		8		11		10		40		240
6		8		8		11		10		48		226
7		8		8		11		10		55	3·0	212
8		8		8	1·0	11		10		63		198
9		8		8		11		9	1·95	70		184
10	0·7	8		8		11		9		69		170
11		8	0·7	8		11	0·8	9		69	2·7	156
12		8		10		11		21		68		156
13		8		12	1·0	11		33		67		156
14		8		15		11		45		66	2·7	156
15	0·7	8		17		11	1·8	57		66		156
16		8		19		11		58	1·9	65		155
17		8		22		11		59		65		155
18		8		24		9		60		64		154
19		8		27		9		60		63		153
20		8		30	0·8	9		61		62		152
21		8	1·5	33		9		62	1·85	61		152
22	0·7	8		25		9		63		75		151
23		8		18		11		64		80		150
24		8	1·0	11		11		65		103		149
25		8		11	1·0	11	1·9	65		117	2·65	148
26		8		11		11		60		131		151
27		8		11		11		55		145		154
28		8		11		11		50		159	2·7	156
29		8				11		45		173		156
30	0·7	8				11		40		187		155
31		8				11			2·95	202		

Daily Gauge Heights and Discharges of Belknap Creek near Belknap Lake for 1913—*Con.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	154	....	87	....	48	....	44	....	25	....	40
2	....	153	....	81	....	55	....	33	....	30	....	40
3	....	152	....	75	....	63	1·3	22	....	35	....	40
4	....	150	....	70	....	70	....	22	....	40	1·6	41
5	....	148	1·9	65	....	78	....	22	....	45	....	41
6	....	146	....	63	....	85	....	22	....	50	....	41
7	....	143	....	61	2·2	93	....	22	....	55	....	40
8	2·6	141	....	59	....	88	....	22	1·85	61	....	40
9	....	138	1·8	57	....	82	1·3	22	....	56	....	39
10	....	135	....	57	....	76	....	152	....	49	....	38
11	....	131	....	57	1·95	70	....	282	....	44	....	38
12	2·5	127	....	57	....	59	3·9	409	....	41	....	37
13	....	120	....	57	....	48	3·6	343	1·55	37	....	36
14	....	113	....	57	1·55	37	....	246	....	37	....	36
15	....	106	....	57	....	35	....	148	....	37	....	35
16	....	99	1·8	57	....	35	1·8	57	....	37	....	35
17	2·2	93	....	59	....	31	....	57	....	37	....	34
18	....	105	....	61	....	28	....	56	....	37	....	34
19	2·4	114	....	63	....	26	....	56	....	38	1·5	33
20	....	140	1·9	65	1·35	25	....	55	....	38	....	32
21	....	166	....	63	....	31	....	55	....	38	....	31
22	2·9	192	1·6	41	1·55	37	....	54	....	38	....	30
23	....	183	....	39	....	41	....	54	....	38	....	29
24	....	174	....	37	....	45	1·75	53	....	39	....	28
25	....	165	....	36	....	50	....	47	....	39	....	27
26	2·7	156	....	34	....	54	....	41	....	39	....	26
27	....	144	1·5	33	....	58	....	35	....	39	....	25
28	....	132	....	33	....	62	....	29	....	39	....	24
29	....	120	....	33	1·92	67	....	23	....	40	....	23
30	....	106	1·5	33	....	56	1·15	15	....	40	1·3	22
31	2·2	93	....	40	....	....	....	20	....	....	....	21

BOULDER CREEK.

Location.—Section 28, township 3, range 27, west of 6th meridian, near mouth of creek and near Jones lake.

Records Available.—January 1 to October 18, 1913.

Winter Conditions.—Stream frozen parts of January, February, and March.

Gauge.—A fine wire is stretched tightly across the stream, and the distance down to the surface of the water is measured with a graduated rod. This rod is graduated just like an ordinary staff gauge, so that the actual readings are reversed, i.e., for a higher stage there is a smaller gauge reading.

Channel.—Bed of stream covered with rocks, giving an uneven bottom but good control.

Discharge Measurements.—Four meter measurements during 1911, 1912, and 1913 show good agreement, and cover all but the highest stages.

Accuracy.—The roughness of the bed of the stream will tend to impair the accuracy.

Boulder creek flows into Jones creek just below Jones lake in section 33, township 3, range 27, west of the 6th meridian, at an altitude of something like 1,950 feet. It drains a small mountainous watershed with an altitude of from 3,000 to 8,000 feet.

The flow of Boulder creek could easily be included in the development of Jones creek for hydro-electric power. An outline of a proposed scheme of development is given under Jones creek.

The flow of this creek is being investigated in connection with Jones creek for the Vancouver Power Company, by Messrs. Anderson and Warden, Civil Engineers, Vancouver. The gauge readings supplied by their men are combined with meter measurements made by the engineers of this survey to give the flow of the stream as shown below.

DISCHARGE MEASUREMENTS of Boulder Creek Mouth (Jones lake), 1911, 1912, and 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
1911.							
Nov. 3	K. H. Smith	1,057	28	24	0·5	10·8	12·6
1912.							
Sept. 18	C. G. Cline	1,046	30	24	0·5	10·75	13·4
1913.							
July 24	K. G. Chisholm	1,055	27	52	1·6	10·1	84·6
Sept. 11	K.G.C. & F.M	1,055	32	34	1·0	10·4	34·6

NOTE.—This gauge records the distance down from a fixed wire. Hence the readings are less for a higher discharge.

Monthly Discharge of Boulder Creek near Jones lake for 1913.

Month.	Discharge in Second-Feet.			Run-off.
	Maximum.	Minimum.	Mean.	Total in acre-feet.
April	130	12	42·2	2,510
May	200	22	118·0	7,260
June	250	113	169·3	10,100
July	220	43	117·2	7,200
August	50	15	28·3	1,740
September	200	15	42·3	2,520
October	340	16	66·5	4,090
November	200	25	58·4	3,475
December	50	15	24·6	1,510

Daily Gauge Heights and Discharges of Boulder Creek near Mouth for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feef.	Sec.-ft.	Feet.	Sec.-ft.
1	10·65	19	10·75	15	Frozen..	....	10·80	13	10·55	25	9·30	240
2	10·65	19	10·75	15	....	....	10·85	12	10·55	25	9·25	250
3	Frozen..	....	10·75	15	10·80	13	10·85	12	10·60	22	9·25	250
4	....	....	10·75	15	10·80	13	10·85	12	10·60	22	9·32	236
5	....	....	Frozen..	....	10·70	16	10·85	12	10·60	22	9·80	140
6	....	....	....	....	10·70	16	10·85	12	10·50	28	9·80	140
7	....	....	....	....	10·65	19	10·85	12	10·15	75	9·55	190
8	....	....	....	....	10·60	22	10·85	12	9·75	150	9·70	160
9	....	....	....	....	10·60	22	10·85	12	9·60	180	9·80	140
10	....	....	....	....	10·60	22	10·75	15	9·70	160	9·80	140
11	....	....	Frozen..	....	10·65	19	10·40	37	9·75	150	9·80	140
12	....	....	10·85	12	10·65	19	10·00	105	9·90	120	9·80	140
13	....	....	10·85	12	10·70	16	10·15	75	9·90	120	9·50	200
14	....	....	10·80	13	10·70	16	10·25	57	10·05	95	9·60	180
15	....	....	10·40	37	10·70	16	10·25	57	9·95	113	9·80	140
16	....	....	9·80	140	10·65	19	10·35	43	10·00	105	9·80	140
17	Frozen..	....	9·85	130	10·50	28	10·35	43	10·10	85	9·95	113
18	....	....	10·30	50	10·60	22	10·20	65	10·15	75	9·90	120
19	....	....	10·50	28	Frozen..	....	9·90	120	9·95	113	9·50	200
20	....	....	10·55	25	....	....	10·05	95	10·00	105	9·40	220
21	....	....	10·60	22	....	....	9·85	130	10·00	105	9·70	160
22	....	....	10·65	19	....	....	10·15	75	9·80	140	9·70	160
23	....	....	Frozen..	....	....	....	10·25	57	9·50	200	9·70	160
24	....	....	....	....	....	....	10·30	50	9·50	200	9·70	160
25	....	....	....	....	....	....	10·40	37	9·50	200	9·70	160
26	....	....	....	....	....	....	10·25	58	9·50	200	9·70	160
27	....	....	....	....	....	....	10·35	43	9·50	200	9·70	160
28	....	....	....	....	....	....	10·45	33	9·65	170	9·70	160
29	10·70	16	....	....	Frozen..	....	10·45	33	9·80	140	9·70	160
30	10·70	16	....	....	10·80	13	10·50	28	9·80	140	9·70	160
31	10·70	16	....	....	10·80	13	....	....	9·60	180	....	....

DAILY GAUGE HEIGHTS AND DISCHARGES Boulder Creek near Mouth for 1913—*Con.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	9·75	150	10·35	43	10·75	15	10·65	19	10·40	37	10·30	50
2	9·90	120	10·35	43	10·75	15	10·70	16	10·50	28	10·40	37
3	10·00	105	10·35	43	10·65	19	10·70	16	10·55	25	10·45	33
4	10·00	105	10·40	37	9·65	170	10·70	16	10·80	28	10·45	33
5	9·80	140	10·45	32	9·50	200	10·70	16	10·45	33	10·45	33
6	9·60	180	10·45	28	10·00	105	10·70	16	10·20	65	10·50	28
7	9·50	200	10·50	28	10·30	50	10·65	19	10·45	33	10·40	37
8	9·80	140	10·30	50	10·45	32	10·60	22	10·35	44	10·50	28
9	9·90	120	10·45	32	10·35	43	10·50	28	10·10	85	10·50	28
10	9·40	220	10·50	28	10·35	43	10·55	25	10·20	65	10·50	28
11	9·85	130	10·55	25	10·40	37	8·80	340	10·35	44	10·50	28
12	9·60	180	10·55	25	10·45	32	9·50	200	10·45	33	10·50	28
13	9·70	160	10·60	22	10·50	28	9·40	220	10·50	28	10·55	25
14	9·90	120	10·50	28	10·55	25	10·00	105	10·55	25	10·55	25
15	10·00	105	10·50	28	10·60	22	10·15	75	10·55	25	10·50	28
16	10·05	95	10·60	22	10·60	22	10·30	50	9·50	200	10·55	25
17	10·05	95	10·35	43	10·65	19	10·35	43	10·05	95	10·55	25
18	10·00	105	10·30	50	10·30	50	10·35	43	10·25	57	10·60	22
19	9·80	140	10·40	37	10·50	28	10·20	65	10·30	50	10·65	19
20	9·80	140	10·50	28	10·60	22	10·20	65	10·35	44	10·65	19
21	9·85	130	10·60	22	10·65	19	10·25	57	10·40	37	10·65	19
22	9·90	120	10·60	22	10·20	65	10·30	50	10·40	37	10·65	19
23	9·95	113	10·60	22	10·40	37	9·85	130	10·50	28	10·65	19
24	10·10	85	10·65	19	10·55	25	9·70	160	9·50	200	10·65	19
25	10·10	85	10·65	19	10·60	22	10·15	75	9·95	112	10·70	16
26	10·20	65	10·65	19	10·65	19	10·30	50	10·15	75	10·75	15
27	10·25	58	10·70	16	10·65	19	10·35	44	10·15	75	10·75	15
28	10·30	50	10·70	16	10·40	37	10·40	37	10·30	50	10·70	16
29	10·10	85	10·70	16	10·50	28	10·55	28	10·35	44	10·75	15
30	10·30	50	10·75	15	10·60	22	10·60	25	10·30	50	10·75	15
31	10·35	43	10·75	15	....	....	10·55	25	....	....	10·75	15

BRANDT CREEK AT MOUTH.

Location.—Section 4, township 7, range 7, west of 7th meridian.

Records Available.—Continuous records since October 19, 1912.

Winter Conditions.—Open water all year.

Gauge.—Vertical staff nailed to tree. Mostly daily readings.

Channel.—Bed of stream covered with rocks, giving a very rough bed. There is ordinarily good control, but there is a possibility of backwater from the Mesliloet river at very high stages.

Discharge Measurements.—One measurement in 1912, and nine in 1913, give good agreement and are well distributed except for high water.

Accuracy.—Accurate except for high stages.

BRANDT CREEK.

Brandt creek rises in the mountains to the east of the Mesliloet river, at an elevation of about 3000 feet, and discharges into the Mesliloet river some 6 miles from its mouth at an elevation of 250 feet. It is part of the Burrard Inlet drainage.

The annual precipitation in the Brandt creek watershed is probably between 120 and 150 inches. In the winter the snowfall is between 2 and 6 feet. In the higher altitudes there are snowfields which remain practically all the year.

At the mouth of the creek the water never freezes over. Higher up, near the mouth of Young creek, there is very little ice, so that open water conditions obtain there also, practically all the year. The heavy snowfall seems to protect the stream from freezing without obstructing the flow to any extent.

The Westminster Power Company proposes to include Brandt creek and its tributaries, Norton and Young creeks, in its high-head development. Norton lake is to be used as a storage and equalizing reservoir, and water is to be diverted into it from upper Brandt creek and from Young lake, as well as from Belknap creek and possibly even Hixon creek. The main pipeline will run from Norton lake to the power plant situated near the mouth of Brandt creek. Wooden pipe will be laid as far as possible on the hydraulic gradient to a small surge reservoir. From that point steel penstocks will be laid to the power-house. This will give a head of about 2000 feet.

Storage dams will be constructed on Young lake, Norton lake and Ann lake. The storage capacity at these three lakes is sufficient to impound practically the whole freshet, and give an equalized flow during the whole year, practically equal to the combined run-off of all the streams. The total amount of water available, while not nearly as great as that of the main Mesliloet river, will yet develop a large amount of power on account of the high head and the good storage facilities.

Gauging stations have been established by this survey at the mouth of Brandt creek and on Brandt creek above Young creek, as well as on the tributaries, Young and Norton creeks. It was hoped that the gauge at the mouth of Brandt would give some idea of the flow at the upper stations, but this has not been found practicable. As soon as facilities are provided for taking more regular gauge readings on the upper stations the station at the mouth of Brandt creek wil be abandoned.

DISCHARGE MEASUREMENTS of Brandt Creek Mouth, 1912 and 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
1912.							
Oct. 19......	C. G. Cline..................	1,046	30	24·7	1·48	2·02	36·6
1913.							
May 29......	H.C. Hughes................	1,673	40	52·6	2·32	2·63	122·0
June 9......	do	1,673	36	49·3	1·91	2·45	94·0
" 18......	do	1,673	36	44·9	1·67	2·35	74·8
" 27......	do	1,673	36	53·0	2·18	2·57	115·5
July 3......	do	1,673	36	42·2	1·41	2·26	59·4
" 29......	do	1,673	19	20·2	0·65	1·62	13·0
Sept. 24......	F. MacLachlan..............	1,673	21	18·7	0·47	1·48	8·8
Nov. 7......	do	1,521	41·5	26·9	1·33	2·08	[1]36·3
" 12......	do	1,521	40·5	22·9	1·10	1·91	25·1
" 13......	do	1,521	40·5	21·3	1·13	1·84	23·8

NOTE.—[1]Different section.

Monthly Discharge of Brandt Creek Mouth for 1913.

Month.	Discharge in Second-Feet.			Run-off.
	Maximum.	Minimum.	Mean.	Total in acre-feet.
January	26	10	16·2	996
February	83	9	24·8	1,380
March	53	12	26·0	1,600
April	165	16	84·8	5,050
May	237	30	124·0	7,620
June	237	65	115·0	6,840
July	174	12	50·7	3,120
August	48	6	10·4	640
September	174	6	34·1	2,030
October	408	8	47·1	408
November	408	14	105·0	6,250
December	246	18	55·0	3,380
The year	408	6	57·8	41,800

Note.—Accuracy "A" and "C".

Monthly Discharge of Brandt Creek Mouth for 1912.

Month.	Discharge in Second-Feet.			Run-off.
	Maximum.	Minimum.	Mean.	Total in acre-feet.
November	318	21	113	6,720
December	110	18	38	2,340

Note.—Accuracy "A".

Daily Gauge Heights and Discharges of Brandt Creek at Mouth for 1912.

Day.	October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	....	1·9	26	1·8	21
2	....	....	2·1	42	....	52
3	....	....	2·45	92	2·4	83
4	....	....	2·25	60	1·85	23
5	....	....	2·8	156	1·85	23
6	....	....	2·65	129	....	20
7	....	....	2·6	120	1·75	18
8	....	....	....	84	1·75	18
9	....	....	2·15	48	1·9	26
10	....	....	2·2	53	1·9	26
11	....	....	2·6	120	2·25	60
12	....	....	....	120	2·25	60
13	....	....	....	120	....	71
14	....	....	2·6	120	2·4	83
15	....	....	....	129	2·2	53
16	....	....	....	138	2·1	42
17	....	....	2·75	147	2·0	33
18	....	....	3·7	318	2·55	110
19	2·02	37	3·6	300	2·05	37
20	1·9	26	....	284	1·95	30
21	....	42	3·2	228	1·9	26
22	....	58	....	169	1·85	28
23	....	74	2·55	110	1·85	23
24	....	90	2·55	110	1·85	23
25	....	106	2·25	60	....	22
26	....	122	2·05	37	1·8	21
27	2·7	138	1·95	30	2·1	42
28	....	111	1·85	23	1·9	26
29	....	85	....	22	1·9	26
30	....	59	1·8	21	1·95	30
31	2·0	33	....	....	2·1	42

DAILY GAUGE HEIGHTS AND DISCHARGES of Brandt Creek near Mouth for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge	Gauge Height.	Discharge	Gauge Height	Discharge.	Gauge Height.	Discharge	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	1·8	21	....	15	1·65	14	1·75	18	2·0	33	2·85	165
2	1·8	21	1·65	14	....	15	1·7	16	2·0	33	....	165
3	1·8	21	....	13	1·7	16	1·85	23	....	32	2·85	165
4	....	19	1·6	12	1·75	18	2·0	33	....	31	2·65	129
5	1·7	16	....	12	1·95	30	2·2	53	1·95	30	2·5	101
6	....	16	1·6	12	....	36	1·95	30	2·1	42	....	110
7	....	16	1·6	12	2·1	42	1·9	26	2·5	101	2·6	120
8	....	15	1·6	12	2·15	48	1·9	26	2·75	147	....	106
9	....	15	....	11	2·2	53	2·2	53	....	178	2·45	92
10	....	14	1·55	10	2·[illegible]	33	2·4	83	3·1	21[illegible]	2·5	101
11	....	14	1·55	10	[illegible]·0	33	2·8	156	....	192	2·5	101
12	....	13	1·5	9	2·0	33	2·8	156	2·9	174	2·6	120
13	....	12	1·5	9	....	27	....	124	2·6	1[illegible]0	2·5	101
14	....	11	....	24	1·8	21	2·45	92	....	142	2·4	83
15	....	11	....	39	1·8	21	....	8[illegible]	2·85	165	....	106
16	....	10	....	54	....	28	2·3	67	....	133	2·65	129
17	1·55	10	....	74	....	35	2·3	67	2·5	101	2·6	120
18	....	10	2·4	83	2·1	42	2·6	120	2·5	101	2·35	75
19	1·55	10	2·2	53	1·9	26	2·85	165	2·6	120	2·7	138
20	....	12	....	41	....	25	2·6	120	2·6	120	2·7	138
21	....	14	1·95	30	1·85	24	2·8	156	2·55	110	3·25	237
22	1·7	16	1·9	26	1·75	18	2·4	183	2·7	138	2·55	110
23	....	18	....	24	....	15	2·2	53	2·9	174	2·45	92
24	....	21	....	23	1·6	12	2·7	138	2·85	165	....	101
25	....	24	1·8	21	....	12	....	138	....	128	2·55	110
26	1·9	26	1·75	18	1·6	12	2·7	138	2·45	92	2·55	110
27	....	23	1·7	16	1·6	12	....	120	3·25	237	2·55	110
28	1·8	21	1·7	16	....	22	2·5	101	....	178	2·57	115
29	....	20	....	....	2·0	33	....	77	2·6	120	2·3	67
30	1·75	18	....	....	....	27	2·0	33	....	135	....	65
31	1·7	16	....	....	1·8	21	....	....	....	150	....	....

DAILY GAUGE HEIGHTS AND DISCHARGES of Brandt Creek at Mouth for 1913.—*Concluded.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	63	1·6	12	1·3	6	....	12	1·95	30	2·25	60
2	....	61	1·6	12	1·35	6	....	10	1·75	18	2·1	42
3	2·25	60	....	12	....	62	1·5	9	1·65	14	2·05	37
4	2·3	67	1·6	12	....	118	1·5	9	2·9	174	2·05	37
5	2·35	75	1·45	8	2·9	174	1·45	8	2·4	83	2·05	37
6	2·9	174	1·4	7	2·4	83	1·45	8	2·45	92	2·05	37
7	2·4	83	1·4	7	2·2	53	....	9	2·08	86	2·25	60
8	2·35	75	1·4	7	2·5	101	1·5	9	2·45	92	2·05	37
9	2·2	53	1·4	7	2·3	57	2·5	9	....	80	2·0	33
10	2·4	83	....	7	2·1	42	2·1	42	2·3	67	1·9	26
11	2·15	46	1·4	7	2·1	42	3·0	192	2·1	42	2·6	120
12	2·25	60	1·7	16	1·9	26	4·2	408	1·9	26	2·45	92
13	2·05	37	1·5	9	1·7	16	3·0	192	1·85	24	2·35	75
14	2·0	33	1·5	9	1·65	14	2·45	92	1·75	18	3·3	246
15	2·0	33	....	9	1·6	12	2·4	83	2·3	67	2·7	138
16	2·0	33	1·5	9	1·6	12	2·17	50	3·0	192	2·4	83
17	2·15	48	1·6	12	1·55	10	2·05	37	2·35	75	2·3	67
18	2·3	67	2·15	48	1·55	10	2·0	33	2·05	37	2·2	53
19	2·3	67	1·8	21	1·5	9	2·0	33	2·13	46	2·0	33
20	....	60	1·7	16	1·5	9	1·9	26	2·1	42	1·9	26
21	....	53	1·5	9	....	10	....	22	1·9	26	1·8	21
22	....	45	1·45	8	1·6	12	1·72	17	1·9	26	1·8	21
23	2·05	37	1·45	8	1·5	9	1·9	26	2·2	53	1·8	21
24	2·0	33	1·4	7	1·48	9	1·9	26	4·2	408	1·75	18
25	1·95	30	1·4	7	1·4	7	1·75	18	4·1	390	1·75	18
26	1·85	24	1·4	7	1·4	7	1·65	14	3·5	282	1·75	18
27	1·75	18	1·35	6	1·5	9	1·62	13	3·1	210	2·3	67
28	1·7	16	1·3	6	2·2	53	1·6	12	3·05	200	2·05	37
29	1·62	13	1·3	6	1·8	21	1·6	12	3·2	228	2·0	33
30	....	13	1·3	6	1·65	14	1·53	10	2·4	83	1·75	18
31	1·6	12	1·3	6	....	....	....	20	....	....	2·45	92

BRANDT CREEK ABOVE YOUNG CREEK.

Location.—Section 10, township 7, range 7, west of 7th meridian.

Records Available.—Continuous records since June 1, 1913.

Winter Conditions.—Heavy snowfall but very little ice on the stream. Open water conditions all year.

Gauge.—Vertical staff gauge spiked to tree trunk. Gauge readings once or twice a week.

Channel.—Bed of stream very steep, with rocks and boulders. Water swift at higher stages.

Discharge Measurements.—Six measurements taken during 1913 show good agreement and are well distributed except during high water.

Accuracy.—Infrequency of gauge readings rather impairs accuracy obtained from a good set of meter measurements.

Discharge Measurements of Brandt Creek River above Young Forks, 1913.

Date.	Hydrographer	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
June 3......	H. C. Hughes................	1,673	11	21·5	3·32	1·70	73·5
" 10......	do	1,673	11	16·5	2·24	1·50	37·0
" 18......	do	1,673	11	18·0	3·10	1·60	54·2
July 7......	do	1,673	10	12·9	1·62	1·30	21·0
" 30......	do	1,673	10	8·4	0·56	0·70	[1]4·69
Sept. 23......	F. MacLachlan...............	1,673	9	8·2	0·28	0·51	2·38

Note.—[1]Gauge washed out January, 1913.

Monthly Discharge of Brandt Creek above Young Creek for 1913.

Month.	Discharge in Second-Feet.			Run-off.
	Maximum.	Minimum.	Mean.	Total in acre-feet.
June..	76·0	22·0	40·9	2,440
July..	54·0	7·0	25·5	1,570
August..	5·5	1·4	2·58	160
September..	6·2	2·6	3·9	230
October..	220·0	1·5	19·3	1,190
November..	22·0	3·0	7·1	422
December..	4·1	2·1	3·0	185

Note.—Accuracy "A" and "C".

Daily Gauge Heights and Discharges of Brandt Creek above Young Creek for 1913.

Day.	June. Gauge Height.	June. Discharge.
	Feet.	Sec. ft.
1	....	76
2	....	76
3	1·7	76
4	....	66
5	....	56
6	....	45
7	1·45	34
8	....	35
9	....	36
10	....	38
11	1·5	39
12	....	33
13	....	27
14	1·3	22
15	....	30
16	....	38
17	....	46
18	1·6	54
19	....	49
20	....	44
21	....	39
22	....	34
23	1·4	29
24	....	27
25	1·35	26
26	....	27
27	....	28
28	1·4	29
29	....	33
30	....	37
31	....	....

DAILY GAUGE HEIGHTS AND DISCHARGES of Brandt Creek above Young Creek for 1913—*Con.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge	Gauge Height.	Discharge.	Gauge Height.	Discharge	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	41	....	5·0	....	2·6	0·53	2·8	....	5·1	....	4·0
2	....	45	0·55	3·0	....	3·4	....	2·8	....	7·4	....	4·0
3	....	49	....	3·0	....	4·2	....	2·8	....	9·7	....	4·0
4	1·6	54	....	2·5	....	5·0	....	2·9	....	12·0	....	4·0
5	....	44	0·50	2·5	....	5·5	....	2·9	....	14·3	0·65	4·1
6	....	33	....	2·4	....	5·9	....	2·9	....	16·6	....	4·0
7	1·3	22	....	2·3	0·8	6·2	....	3·0	....	19·0	....	3·9
8	....	25	....	2·2	....	6·0	....	3·0	1·3	22·0	....	3·8
9	....	28	0·45	2·1	....	5·9	0·55	3·0	....	18·0	....	3·7
10	....	31	....	2·1	....	5·7	....	75·0	....	14·0	....	3·6
11	....	35	....	2·2	0·75	5·5	....	147·0	....	10·0	....	3·5
12	1·5	39	....	2·2	....	4·6	2·3	220·0	....	6·0	....	3·4
13	....	31	....	2·3	....	3·8	1·45	34·0	0·55	3·0	....	3·4
14	....	23	....	2·4	0·55	3·0	....	24·2	....	3·0	....	3·2
15	1·2	16	....	2·4	....	3·0	....	14·5	....	3·0	....	3·1
16	....	18	0·50	2·5	....	3·0	0·7	4·8	....	3·0	....	3·0
17	....	19	....	3·5	....	2·9	....	4·7	....	3·0	....	2·8
18	....	21	....	4·5	....	2·9	....	4·6	....	3·0	....	2·7
19	1·3	22	0·75	5·5	....	2·8	....	4·5	....	3·0	0·5	2·5
20	....	22	....	4·3	....	2·8	....	4·4	....	3·0	....	2·5
21	....	22	....	3·2	....	2·7	....	4·2	....	3·5	....	2·4
22	....	22	0·45	2·1	....	2·7	....	4·0	....	3·5	....	2·4
23	1·3	22	....	2·0	0·51	2·6	....	3·9	....	3·5	....	2·4
24	....	20	....	1·9	....	2·8	0·61	3·7	....	3·5	....	2·3
25	....	18	....	1·8	....	3·0	....	3·1	....	3·5	....	2·3
26	1·2	16	0·4	1·7	....	3·2	....	2·7	....	3·5	....	2·3
27	....	14	0·4	1·7	....	3·4	....	2·4	....	3·5	....	2·2
28	....	13	....	1·6	....	3·6	....	2·1	....	3·5	....	2·2
29	....	11	....	1·5	....	3·8	....	1·8	....	3·5	....	2·2
30	7·0	5	0·37	1·4	0·65	4·1	0·38	1·5	....	3·5	0·45	2·1
31	....	7	....	2·0	....	....	....	3·8	....	....	....	2·1

CHEHALIS RIVER.

Chehalis river has its source in Chehalis lake at an elevation of 700 feet, and discharges into Harrison river near Harrison Mills at an elevation of between 30 and 40 feet. It is part of the Harrison-Fraser drainage; the drainage area, as measured from the Railway Belt map (dated January 1, 1911, scale 7.89 miles per inch) is 200 miles. The annual precipitation is about 80 to 90 inches; there is very heavy snow in winter in all except the lowest parts of the water shed, and the winter conditions are fairly severe. At the mouth, however, the stream is open all the year round.

The Chehalis river, from its source in a rough mountainous country, flows through a wide valley, containing very fine timber, to Chehalis lake. Stadia creek, after tumbling over a 200-foot bluff, enters from the west in this valley. Chehalis lake is a deep mountain lake about 7 miles long, with rocky cliffs rising from the water's edge. It is an excellent storage site for power purposes. The lake is well stocked with fish. At the lower end of the lake there is a large log jam at the mouth of the canyon. A dam could be constructed at any one of a number of good places in this canyon. Five miles below the lake the west fork (Statlu creek) flows into the main river. This creek has no lake on it, and it is much more flashy than the main river.

For the last mile or so of its course the Chehalis flows through a delta, and splits up into a number of sections, with frequent changes of the channel. The deposits from the Chehalis are gradually filling up Harrison bay, and at

low water in the Harrison river very extensive flats are exposed. The flow from Harrison lake through the Harrison river is controlled largely by the bar which the Chehalis has formed across the Harrison. The Harrison river rises and falls with the Fraser river. During the low water this bar on the Harrison at the mouth of the Chehalis is a great hindrance to navigation and logging on the Harrison river, which is the connecting link between the 30 miles of navigation on Harrison lake and the Fraser river tidewater.

To reach the Chehalis river it is necessary to gō by water either from Harrison Mills or Harrison Hot Springs; there is no road yet, though surveys have been made for one. From the mouth of the river there is an old logging road for 5 miles to an abandoned logging camp at Boulder creek. This road has been repaired sufficiently for use as a pack trail for horses, and the pack trail has recently been extended to Chehalis lake.

The Chehalis valley was surveyed by A. W. Johnston in 1903 while locating the north limit of the Railway Belt, but with the exception of two ranches on the delta on Harrison bay, none of the country has been settled. It is visited occasionally by timber cruisers and Indians from the reserve at the mouth.

There is a fall of 650 feet between Chehalis lake and the mouth, a distance of 11 miles. There is an excellent storage reservoir in Chehalis lake.

The river station was established November 4, 1911, by C. G. Cline. It is located a mile and a half from the mouth opposite the foot of the first hill on the trail up the river. A chain gauge, supported from a pole fastened to two trees, is located on the right bank; its datum is referred to three bench-marks. Measurements are made by wading, except at high water, when cable measurements are made from a canoe, one quarter of a mile below the gauge. The measuring section is fair; the control is good, the banks high on one side, current uniform, and one channel at low water. At high water, however, the river overflows its left bank and forms two channels. The bed of the stream is liable to cut and shift, expecially during the freshet.

The power possibilities of Chehalis river are being investigated by the Vancouver Power Company. The Canadian Pacific Railway at one time made application for power privileges on the river.

CHEHALIS RIVER.

Location.—One and a half miles from mouth in section 14, township 4, range 30, west of 6th meridian.

Records Available.—November and December, 1911; March 8 to December 31, 1912; January 1 to December 31, 1913.

Winter Conditions.—Open water at gauging station all year.

Gauge.—Chain gauge suspended over river by pole spiked to two trees on the bank.

Channel.—Rocky bed, permanent channel, water swift at higher stages.

Discharge Measurements.—Two in 1911, five in 1912, and two in 1913 agree fairly well, and cover all but the highest and lowest stages.

Accuracy.—Fair.

Discharge Measurements of Chehalis River 1½ miles from mouth, 1911, 1912, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
1911.							
Nov. 3	C. G. Cline	1,053	73	127	1·05	0·85	133[1]
Dec. 14	H. M. Smith	1,057	105	273	3·74	3·80	1,021[2]
1912.							
Mar. 8	C. G. Cline	1,046	110	162	1·82	2·70	295[3]
July 15	do	1,046	123	221	2·42	3·07	535[3]
Sept. 11	do	1,046	105	248	2·40	2·90	594[3]
Nov. 23	do	1,048	140	600	4·85	4·95	2,910[3]
Dec. 4	do	1,048	130	343	3·56	3·92	1,220[3]
1913.							
May 21	do	1,044	145	460	3·90	4·40	1,810[3]
Sept. 8	do	1,055	145	395	3·95	4·40	1,560[3]

Note.—[1] Old staff gauge. [2] New staff gauge. [3] Chain gauge.

Monthly Discharge of Chehalis River 1½ miles from mouth for 1913.

[Drainage area, 200 square miles.]

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
January	1,230	270	551	2·76	3·18	33,900
February	12,500	340	1,350	6·75	7·03	75,000
March	3,100	580	1,084	5·42	6·25	66,600
April	3,450	710	1,465	7·32	8·17	87,000
May	5,550	1,100	2,460	12·30	14·18	151,300
June	2,200	1,430	1,693	8·47	9·45	100,800
July	1,550	450	916	4·58	5·28	56,300
August	750	230	441	2·20	2·54	27,100
September	4,850	250	1,010	5·05	5·63	60,100
October	7,700	270	1,765	8·82	10·17	108,500
November	15,000	420	3,295	16·48	18·40	195,800
December	4,350	820	1,615	8·08	9·32	99,300
The year period	15,000	230	1,467	7·35	99·60	1,061,700

Daily Gauge Heights and Discharges of Chehalis River 1½ miles from Mouth for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	3·6	900	3·2	600	3·4	750	3·7	980	4·25	1,490	4·7	2,200
2	3·6	900	3·25	630	3·4	750	3·6	900	2·15	1,380	4·7	2,200
3	3·5	820	3·1	540	3·4	750	3·4	750	4·1	1,320	4·6	2,000
4	3·35	710	3·0	480	3·5	820	3·35	710	4·05	1,270	4·55	1,910
5	3·3	670	3·0	480	3·6	900	3·4	750	4·05	1,270	4·5	1,820
6	3·2	600	2·9	420	3·8	1,060	3·4	750	3·85	1,100	4·4	1,670
7	3·15	570	3·0	480	3·8	1,060	3·45	790	4·35	1,610	4·4	1,670
8	3·1	540	3·0	480	3·6	900	3·5	820	4·55	1,910	4·5	1,820
9	3·0	480	2·9	420	3·5	820	3·5	820	4·95	2,920	4·4	1,670
10	2·9	420	2·8	360	3·6	900	3·8	1,060	4·85	2,600	4·3	1,550
11	2·85	390	2·8	360	3·5	820	4·2	1,430	4·95	2,920	4·4	1,670
12	2·75	340	2·75	340	3·6	900	4·3	1,550	5·25	4,100	4·5	1,820
13	2·7	310	2·8	360	3·7	980	4·45	1,750	5·35	4,600	4·35	1,610
14	2·7	310	2·9	420	3·7	980	4·3	1,550	5·45	5,100	4·3	1,550
15	2·6	270	3·9	1,140	3·7	980	4·2	1,430	5·55	5,550	4·4	1,670
16	2·6	270	7·0	12,500	3·8	1,060	4·1	1,320	5·25	4,100	4·4	1,670
17	2·6	270	5·5	5,300	5·0	3,100	4·2	1,430	5·05	3,280	4·3	1,550
18	2·6	270	4·9	2,750	4·7	2,200	4·3	1,550	4·65	2,100	4·3	1,550
19	2·6	270	4·5	1,820	4·5	1,820	4·6	2,000	4·55	1,910	4·4	1,670
20	2·7	310	4·2	1,430	4·3	1,550	4·65	2,100	4·45	1,750	4·5	1,820
21	2·7	310	3·9	1,140	3·95	1,180	5·1	3,450	4·4	1,670	4·4	1,670
22	2·8	360	3·7	980	3·65	940	4·9	2,750	4·2	1,430	4·5	1,820
23	2·7	310	3·5	820	3·4	750	4·75	2,320	4·3	1,550	4·4	1,670
24	3·3	670	3·45	780	3·15	580	4·4	1,670	4·4	1,670	4·3	1,550
25	4·0	1,230	3·4	750	3·3	670	4·3	1,550	4·6	2,000	4·3	1,550
26	3·7	980	3·35	710	3·2	600	4·45	1,750	4·9	2,750	4·25	1,490
27	3·5	820	3·3	670	3·5	820	4·4	1,670	5·3	4,350	4·2	1,430
28	3·4	750	3·3	670	3·7	980	4·3	1,550	4·9	2,750	4·3	1,550
29	3·4	750	....	....	4·2	1,430	4·2	1,430	4·6	2,000	4·25	1,490
30	3·3	670	....	....	4·2	1,430	4·15	1,380	4·5	1,820	4·25	1,490
31	3·2	600	....	....	3·9	1,140	....	....	4·6	2,000	....	....

DAILY GAUGE HEIGHTS AND DISCHARGES of Chehalis River 1½ miles from mouth for 1913—Con.

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	4·0	1,230	3·0	480	2·6	270	2·7	310	2·9	420	4·8	2,450
2	3·9	1,140	2·9	420	2·7	310	2·7	310	3·0	480	4·6	2,000
3	4·0	1,230	2·85	390	4·7	2,200	2·6	270	3·1	540	4·45	1,750
4	4·0	1,230	2·85	390	5·4	4,850	2·6	270	4·3	1,550	4·3	1,550
5	4·2	1,430	2·9	420	5·0	3,100	2·6	270	4·0	1,230	4·2	1,430
6	4·0	1,230	3·0	480	4·6	2,000	2·7	310	4·1	1,320	4·1	1,320
7	4·0	1,230	3·0	480	4·2	1,430	3·8	1,060	4·2	1,430	4·5	1,820
8	4·1	1,320	2·9	420	4·3	1,550	3·9	1,140	4·9	2,750	4·3	1,550
9	4·2	1,430	2·8	360	4·4	1,670	4·2	1,430	4·9	2,750	4·1	1,320
10	4·3	1,550	2·9	420	4·2	1,430	5·0	3,100	5·2	3,850	4·0	1,230
11	4·2	1,430	2·8	360	4·0	1,230	5·2	3,850	4·6	2,000	3·85	1,100
12	4·1	1,320	3·2	600	3·9	1,140	5·6	5,800	4·3	1,550	3·7	980
13	3·8	1,060	3·1	540	3·7	980	6·0	7,700	4·1	1,320	3·6	900
14	3·8	1,060	3·1	540	3·55	860	5·7	6,250	4·2	1,430	3·9	1,140
15	3·6	900	3·0	480	3·4	750	5·3	4,350	4·55	1,910	5·3	4,350
16	3·5	820	2·9	420	3·3	670	5·0	3,100	7·2	13,500	5·0	3,100
17	3·4	750	3·2	600	3·15	570	4·6	2,000	5·1	3,450	4·8	2,450
18	3·35	710	3·4	750	3·0	480	4·7	2,200	4·9	2,750	4·6	2,000
19	3·3	670	3·2	600	2·9	420	4·6	2,000	4·9	2,750	4·3	1,550
20	3·25	630	3·1	540	2·8	360	3·8	1,060	4·8	2,450	4·1	1,320
21	3·1	540	3·1	540	2·8	360	3·7	980	4·5	1,820	4·0	1,230
22	3·0	480	3·0	480	2·7	310	3·7	980	4·2	1,430	3·9	1,140
23	2·95	450	2·9	420	2·6	270	3·65	940	4·2	1,430	3·8	1,060
24	3·2	600	2·85	390	2·6	270	3·5	820	7·5	15,000	3·7	980
35	3·3	670	2·8	360	2·55	250	3·4	750	6·1	8,200	3·6	900
26	3·2	600	2·75	340	2·6	270	3·3	670	5·6	5,800	3·5	820
27	3·2	600	2·9	420	2·6	270	3·3	670	5·4	4,850	3·5	820
28	3·1	540	2·65	290	3·4	750	3·2	600	5·3	4,350	4·8	2,450
29	3·1	540	2·6	270	3·3	670	3·1	540	5·1	3,450	4·65	2,100
30	3·0	480	2·55	250	3·2	600	3·05	510	5·0	3,100	4·5	1,820
31	3·1	540	2·5	230	....	....	3·0	480	....	....	4·2	1,430

CHILLIWACK RIVER.

Location.—Five miles above Sumas lake in section 1, township 23, east of Coast meridian.

Records Available.—Continuous since 1911.

Winter Conditions.—Open water at gauging station all year.

Gauge.—Vertical staff gauge on rock-filled crib, Gauge readings daily.

Channel.—Rocky bottom, water deep, swift at higher stages, good control.

Discharge Measurements.—Eight measurements during 1911, 1912, and 1913 show good agreement and are fairly will distributed.

Accuracy.—Results are quite accurate.

CHILLIWACK RIVER.

The Chilliwack river has its source in Chilliwack lake at an elevation of 2,080 feet. It passes through the Vedder river channel and empties into Sumas lake, which is less than 100 feet above sea-level. The drainage area is about 450 square miles, about one-quarter of which lies in the state of Washington The district is very humid, the precipitation being from 40 inches to 70 inches per annum. The water is at present unused, but there are power possibilities on the stream.

Chilliwak River—Metering Station at Indian Dug out.

The control of the flow of this river is of great importance in connection with the Sumas Dyking Project. The Chilliwack river is subject to severe floods, and owing to its flat grade on the lower reaches, is a source of considerable damage to the rich farming districts in that locality. For the upper two-thirds of its length the river is separated from the valley of the Fraser by the Cheam mountains, the highest peak of which rises to an elevation of 9,000 feet. Opposite, on the south, mount Baker rises abruptly to an even greater height. The bottom slopes of the valley are well covered with timber, some of it of excellent quality. A wagon road has been constructed from the lower end of

Chilliwak River, looking downstream past Gauging Station.

the valley, near Chilliwack, some 8 miles up the river; beyond this there is evidence of an old trail very much overgrown, and impassible in many places. The slopes of the valley in its lower reaches are characterized by high bluffs of sedimentary or glacial origin subject to enormous slides or slips. The stream has a fast current and its bed is composed of large boulders that have been washed out of the many slides along its course. The elevation of Chilliwack lake is 2,080 feet, the shores and adjacent slopes being covered with alder and brush. The lake has an area of about 2,600 acres.

The lower reaches of this river seem to have been changed very much due to dykes and other artificial conditions. Previously it seems to have spread over the country in a number of channels, most of which finally found their way to the Fraser.

The Chilliwack river used to flow through what is now called the Luckakuck channel to the Fraser. Some twenty years ago the river was dammed and diverted by the residents living along that channel (near Sardis) and made to flow through the channel of Vedder creek into Sumas lake, and indeed the Chilliwack is locally referred to as the Vedder river.

There are excellent power possibilities on the Chilliwack river, but on account of inaccessibility and the probable high cost of development they have not been carefully investigated.

The station was established on November 14, 1911, by K. H. Smith. It is located about 6 miles from the town of Chilliwack and about 300 yards above the highway bridge known as the Vedder river crossing. The gauge is a standard vertical staff gauge, 8 feet long, and is attached to a rock-filled crib.

Measurements are made by current-meter from a canoe held in place by a cable attached to the cribbing to which the gauge is secured, or by using a special traveller on the cable and suspending the meter from it.

The banks are moderately high and are protected by timber cribbing, confining the stream to a single channel.

There are two bench-marks which are referred to the datum of the gauge.

Discharge Measurements of Chilliwack River near Vedder River Hotel, 1911-14.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
1911.							
Dec. 18	Smith	1,057	76	451·2	2·61	1·70	1,180
1912.							
Mar. 21	C. G. Cline	1,046	65	424·0	1·76	1·00	750
" 22	do	1,046	65	508·5	1·52	1·00	770
July 8	do	1,046	85	658·0	4·69	2·90	3,090
Aug. 30	do	1,046	65	552·0	2·03	1·60	1,120
Nov. 21	do	1,048	85	684·0	5·32	3·15	3,640
1913.							
June 5	H. G. Chisholm	1,044	165	969·0	8·90	5·00	8,640
July 13	H. J. E. Keys	1,055	155	710·0	7·41	4·05	5,270
1914.							
Jan. 10	H. J. E. Keys	1,046	110	816·0	5·47	3·65	4,450
" 13	do	1,046	100	718·0	4·31	2·80	3,090
" 12	do	1,046	105	740·0	4·49	2·98	3,320
" 15	do	1,046	95	790·0	3·70	2·70	2,920
" 17	do	1,046	95	780·0	3·27	2·54	2,550

Monthly Discharge of Chilliwack River near Mouth for 1913.

(Drainage area, 450 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
January	1,360	960	1,208	2·68	3·09	74,400
February	10,100	815	1,942	4·31	4·49	108,000
March	1,160	1,020	1,064	2·37	2·73	65,400
April	3,260	960	1,557	3·47	3·87	92,600
May	8,900	1,500	4,416	9·81	11·31	272,000
June	12,200	5,920	4,779	10·62	11·85	284,000
July	8,100	3,620	5,724	12·72	14·64	352,000
August	3,440	1,250	2,302	5·12	5·90	141,000
September	8,500	1,250	2,664	5·93	6·62	158,000
October	10,500	960	2,770	6·16	7·10	170,000
November	5,360	1,500	2,533	5·63	6·28	150,000
December	2,750	960	1,557	3·46	3·99	95,600
The year	12,200	815	2,710	6·02	81·87	1,963,000

Note.—Accuracy "A".

Daily Guage Heights and Discharges of Chilliwack River near Mouth for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	1·7	1,250	1·3	960	1·4	1,020	1·35	990	2·2	1,910	5·0	8,900
2	1·7	1,250	1·3	960	1·4	1,020	1·35	990	2·0	1,620	5·85	12,200
3	1·7	1,250	1·3	960	1·4	1,020	1·3	960	1·95	1,565	5·8	12,000
4	1·7	1,250	1·3	960	1·4	1,020	1·3	960	2·0	1,620	5·7	11,600
5	1·8	1,360	1·25	930	1·4	1,020	1·3	960	1·9	1,500	5·2	9,700
6	1·8	1,360	1·25	930	1·5	1,080	1·3	960	2·0	1,620	4·85	8,300
7	1·7	1,250	1·20	900	1·5	1,080	1·3	960	2·2	1,910	4·95	8,700
8	1·7	1,250	1·20	900	1·5	1,080	1·3	960	2·9	3,090	5·2	9,700
9	1·7	1,250	1·1	840	1·5	1,080	1·3	960	3·5	4,200	5·0	8,900
10	1·7	1,250	1·1	840	1·5	1,080	1·35	990	3·7	4,600	4·6	7,340
11	1·7	1,250	1·1	840	1·5	1,080	1·7	1,250	3·3	3,800	4·4	6,600
12	1·7	1,250	1·1	840	1·5	1,080	2·3	2,070	3·4	4,000	4·5	6,970
13	1·7	1,250	1·05	815	1·5	1,080	2·25	1,990	3·5	4,200	5·4	10,500
14	1·7	1,250	1·05	815	1·5	1,080	2·2	1,910	3·4	4,000	5·0	8,900
15	1·7	1,250	2·1	1,760	1·5	1,080	2·3	2,070	3·3	3,800	4·5	6,970
16	1·7	1,250	4·6	7,340	1·5	1,080	2·2	1,910	3·4	4,000	4·4	6,600
17	1·7	1,250	5·3	10,100	1·55	1,120	2·0	1,620	3·2	3,620	4·3	6,250
18	1·7	1,250	3·6	4,400	1·6	1,160	2·3	2,070	3·0	3,260	4·2	5,920
19	1·7	1,250	2·8	2,920	1·6	1,160	2·5	2,410	3·1	3,440	4·6	7,340
20	1·7	1,250	2·7	2,750	1·5	1,080	2·8	2,920	3·2	3,620	5·2	9,700
21	1·6	1,160	2·4	2,240	1·5	1,080	3·0	3,260	3·4	4,000	4·8	8,100
22	1·6	1,160	2·1	1,760	1·5	1,080	2·9	3,090	3·8	4,840	4·6	7,340
23	1·6	1,160	2·0	1,620	1·5	1,080	2·8	2,920	4·22	5,920	4·55	7,150
24	1·65	1,200	1·9	1,500	1·5	1,080	2·9	3,090	4·3	6,250	4·5	6,970
25	1·65	1,200	1·9	1,500	1·4	1,020	2·6	2,580	4·4	6,600	4·55	6,800
26	1·6	1,160	1·7	1,250	1·4	1,020	2·7	2,750	4·8	8,100	4·4	6,600
27	1·6	1,160	1·5	1,080	1·4	1,020	2·5	2,410	5·0	8,900	4·5	6,970
28	1·5	1,080	1·5	1,080	1·4	1,020	2·45	2,325	4·9	8,500	4·45	6,800
29	1·4	1,020	....	....	1·4	1,020	2·4	2,240	4·7	7,720	4·4	6,600
30	1·3	960	....	....	1·4	1,020	2·3	2,070	4·5	6,970	4·5	6,970
31	1·3	960	....	....	....	....	....	....	4·7	7,720	....	....

Daily Gauge Heights and Discharges of Chilliwack River near Mouth for 1913—*Concluded.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	4·6	7,340	3·1	3,440	1·8	1,360	1·7	1,250	2·2	1,910	2·7	2,750
2	4·4	6,600	3·1	3,440	1·7	1,250	1·7	1,250	2·0	1,620	2·6	2,580
3	4·2	5,920	3·0	3,260	2·0	1,620	1·6	1,160	1·9	1,500	2·5	2,410
4	3·9	5,100	3·1	3,440	4·9	8,500	1·5	1,080	2·0	1,620	2·4	2,240
5	4·0	5,360	3·0	3,260	4·7	7,720	1·4	1,020	2·2	1,910	2·3	[illegible],070
6	4·4	6,600	[illegible]·9	3,090	4·0	5,360	1·4	1,020	2·1	1,760	2·2	1,910
7	4·8	8,100	3·0	3,260	3·8	4,840	1·3	960	2·0	1,62[illegible]	2·3	2,070
8	4·6	7,340	2·9	3,090	3·4	4,000	1·3	960	2·1	1,760	2·3	2,070
9	4·4	6,6[illegible]	2·8	2,920	3·1	3,440	1·4	1,020	2·4	2,240	2·2	1,910
10	4·5	6,970	2·7	2,750	2·8	2,920	1·5	1,080	2·3	2,070	2·2	1,910
11	4·7	7,720	2·8	2,920	2·7	2,750	5·4	10,500	2·2	1,910	2·1	1,760
12	4·5	6,970	2·7	2,750	2·6	2,580	4·4	6,600	2·1	1,760	2·0	1,620
13	4·1	5,620	2·6	2,580	2·5	2,410	4·9	8,500	2·0	1,620	1·9	1,500
14	3·8	4,840	2·7	2,750	2·4	2,240	3·9	5,100	1·9	1,500	2·0	1,620
15	3·6	4,400	2·5	2,410	2·3	2,070	3·5	4,200	1·9	1,500	2·1	1,760
16	3·5	4,200	2·2	1,910	2·2	1,910	3·2	3,620	3·7	4,600	1·8	1,360
17	3·4	4,000	2·3	2,070	2·4	2,240	3·0	3,260	3·2	3,620	1·9	1,500
18	3·6	4,400	2·3	2,070	2·7	2,750	2·8	2,920	3·8	2,920	1·8	1,360
19	4·1	5,620	2·2	1,910	2·1	1,760	2·7	2,750	2·7	2,750	1·7	1,250
20	4·3	6,250	2·1	1,760	2·1	1,760	2·6	2,580	2·5	2,410	1·6	1,160
21	4·6	7,340	1·9	1,500	2·2	1,910	2·7	2,750	2·4	2,240	1·5	1,080
22	4·5	6,970	1·8	1,360	2·2	1,910	2·6	2,580	2·3	2,070	1·6	1,160
23	4·4	6,600	1·7	1,250	2·1	1,760	2·7	2,750	2·2	1,910	1·5	1,080
24	4·2	5,920	1·9	1,500	2·1	1,760	3·0	2,070	4·0	5,360	1·4	1,020
25	4·0	5,360	2·0	1,620	2·0	1,620	2·7	2,750	3·7	4,600	1·5	1,080
26	3·9	5,100	1·9	1,500	1·9	1,500	2·5	2,410	3·3	3,800	1·4	1,020
27	3·7	4,600	1·8	1,360	1·8	1,360	2·4	2,240	3·3	3,800	1·4	1,020
28	3·5	4,200	2·0	1,620	2·1	1,760	2·3	2,070	3·0	3,260	1·5	1,080
29	3·4	4,000	1·9	1,500	1·9	1,500	2·2	1,910	3·0	3,260	1·4	1,020
30	3·3	3,800	2·0	1,620	1·8	1,360	2·1	1,760	2·9	3,090	1·3	960
31	3·2	3,620	1·9	1,500	....	....	2·1	1,760	....	....	1·3	960

COQUIHALLA RIVER.

Location.—Near mouth of river and town of Hope, in section 10, township 5, range 26, west of 6th meridian.

Records Available.—Continuous records since November 16, 1911.

Winter Conditions.—Open water at gauging station all year.

Gauge.—Chain gauge on highway bridge; gauge readings two or three times a week. Some trouble with gauge chain stretching.

Channel.—Bottom rocky and streams rather shallow. Water swift at the higher stages.

Discharge Measurements.—Eleven meter measurements during 1912 and 1913 show some discrepancies, and do not cover highest stages.

Accuracy.—Records only moderately accurate on account of infrequency of gauge readings and a number of changes in the length of the chain.

COQUIHALLA RIVER.

Coquihalla river has its source in the pass betwen the Coquihalla and Coldwater rivers, at an elevation of 3,000 feet, and discharges into the Fraser river near Hope at an elevation of 120 feet. It is part of the Fraser drainage; the drainage area, as measured from a Dominion sectional map, scale 3 miles to an inch, is 360 square miles. The annual precipitation varies from 50 inches

at the mouth to about 80 inches at the headwaters. At Hope the winters are quite mild, and the stream does not freeze over. In the higher altitudes the winters are much more severe.

The following tributaries enter from the left going upstream; the Kawkaw, Ladner, and Boston Bar creeks; Nicolum creek and Pierra river enter from the right.

Just above the mouth of the Nicolum, and about 6 miles from the Fraser is the site of a proposed power development, about 1½ acres in extent. The river flows through a gorge with preciptous rocky walls from 30 to 70 feet in width, and about 150 feet in height. By constructing a dam at the head of the gorge, and a tunnel through the mountains for about 1,000 feet to the power site, from 100 to 125 feet head could be obtained. Storage facilities, however, are undefined, as yet and may be limited by the railroad construction in the valley. A few hundred feet below the mouth of the Nicolum, there is another small canyon and falls; but to use this section of the river in conjunction with the other would be very expensive.

The river station on the Coquihalla was established April 10, 1912, by C. G. Cline. It is located at the upper highway bridge, a mile from the mouth. A chain gauge 24 feet long is attached to the middle of the bridge on the downstream side, and its datum is referred to three bench-marks. Cable measurements are made from the down stream side of the bridge. The control is good, the banks are high, the current fairly uniform, and the stream has a permanent rocky channel. In the freshet season the water might flow in two channels, but entirely under the bridge.

DISCHARGE MEASUREMENTS of Coquihalla River near Mouth 1911, 1912 and 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
1911.							
Nov. 16	C. G. Cline	....	....	....	....	1·15	[1]333
Dec. 12	K. H. Smith	....		....	....	2·05	[1]1,220
1912.							
Feb. 29	C. G. Cline	....	....	....	....	1·25	[1]422
	New Gauge established April 10, 1912.						
June 8	Cline, Carbould	1,046	149	597	4·8	3·30	[2]2,880
" 29	C. G. Cline	1,046	122	275	3·2	1·90	890
Sept. 13	do	1,046	110	171	2·0	1·05	334
Nov. 15	do	1,048	120	276	2·8	1·65	762
" 18	do	1,048	120	350	3·5	2·25	1,210
" 20	do	1,048	120	386	3·9	2·45	1,510
1913.							
May 12	C. G. C. & K. G. C.	1,044	150	576	5·7	3·50	3,140
June 21	C. G. C. & K. G. C.	1,044	154	540	5·8	3·65	3,040
July 21	K. G. Chisholm	1,055	122	378	3·7	2·60	1,410
Sept. 9	K. G. C. & F. MacL.	1,055	119	383	3·7	2·70	1,440
Oct. 13	H. J. E. Keys	1,057	129	524	6·0	3·47	3,160

NOTE.—[1] Old gauge. [2] New gauge.

Monthly Discharge of Coquihalla River near Mouth for 1913.

(Drainage area, 360 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
January	1,580	320	557	1·55	1·79	34,200
February	2,400	250	592	1·64	1·71	32,900
March	560	270	391	1·08	1·25	24,000
April	2,310	230	1,195	3·32	3·70	70,800
May	6,070	890	3,330	9·25	10·66	20,500
June	7,040	2,480	3,961	11·00	12·27	203,500
July	2,480	850	1,705	4·74	5·46	104,500
August	970	330	580	1·63	1·88	35,700
September	3,110	320	1,000	2·78	3·10	59,500
October	5,690	320	1,665	4·62	5·33	102,000
November	2,310	770	1,243	3·45	3·85	73,800
December	1,240	470	719	2·00	2·31	44,200
The year	7,040	230	1,412	3·92	53·31	1,022,000

Note.—Accuracy "A", "B" and "C".

Daily Guage Heights and Discharges of Coquihalla River near Mouth for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feef.	Sec.-ft.	Feet.	Sec.-ft.
1	1·1	370	1·0	320	1·0	320	....	270	....	1,050	....	6,370
2	....	370	....	320	....	320	0·8	240	....	970	5·6	7,040
3	....	370	1·0	320	1·0	320	....	240	1·9	890	5·5	6,840
4	1·1	370	....	300	....	320	0·75	230	....	900	....	5.640
5	....	350	....	280	1·0	320	....	230	....	910	4·25	4,450
6	1·0	320	0·9	270	1·05	350	....	240	1·95	930	....	4,500
7	....	370	....	320	....	440	0·8	240	....	1,430	4·3	4,550
8	1·2	420	1·1	370	1·4	530	....	310	2·9	2,000	....	4,350
9	1·05	350	....	400	....	550	....	390	....	3,000	4·1	4,160
10	....	350	....	440	1·45	560	1·3	470	4·0	3,960	4·3	4,550
11	1·05	350	1·3	470	1·3	470	....	910	....	3,590	....	4,350
12	....	430	0·9	270	....	470	2·4	1,340	....	3,210	4·1	4,160
13	....	510	0·85	250	1·3	470	....	1,370	3·4	2,840	....	3,690
14	1·5	590	....	510	....	420	2·45	1,400	....	2,730	....	3,220
15	....	640	1·75	770	1·1	370	2·45	1,400	....	2,620	3·35	2,750
16	1·65	690	....	1,580	....	450	....	1,600	....	2,480	....	3,110
17	....	750	3·15	2,400	1·4	530	....	1,800	3·1	2,310	....	3,470
18	1·8	810	....	1,660	1·4	530	....	1,980	....	2,440	....	3,830
19	....	1,050	1·95	930	....	480	....	2,180	3·3	2,660	....	4,190
20	....	1,280	....	780	....	430	3·1	2,310	....	3,360	4·3	4,550
21	2·6	1,580	1·55	630	1·1	370	....	2,310	....	4,060	3·7	3,390
22	....	1,100	....	560	1·1	370	3·1	2,310	....	4,760	....	3,210
23	1·55	630	....	480	....	340	....	2,010	4·75	5,410	....	3,030
24	1·15	400	1·15	400	1·0	320	....	1,700	4·85	5,600	....	2,840
25	1·15	400	....	400	....	320	2·4	1,340	4·85	5,600	3·3	2,660
26	....	400	....	400	1·0	320	2·6	1,580	5·1	6,070	....	2,780
27	1·15	400	1·15	400	0·95	300	2·7	1,710	....	5,820	....	2,900
28	....	410	....	360	0·9	270	2·4	1,340	....	5,570	3·5	3,020
29	1·2	420	....	....	....	280	....	1,240	....	5,320	....	2,750
30	1·2	420	....	....	....	290	2·2	1,150	4·55	5,030	3·2	2,480
31	....	370	....	....	0·95	300	....	....	....	5,700	....	....

DAILY GAUGE HEIGHTS AND DISCHARGES of Coquihalla River near Mouth for 1913—*Concluded.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	3·2	2,480	....	790	1·0	320	....	380	2·1	1,060	2·3	1,240
2	....	2,480	1·7	730	....	320	....	390	1·9	890	2·1	1,060
3	....	2,480	....	700	1·0	320	....	400	....	905	....	1,030
4	....	2,480	....	680	....	1,710	1·15	400	....	920	....	1,000
5	3·2	2,480	....	660	3·55	3,110	....	370	1·95	930	....	970
6	....	2,480	....	640	....	2,880	....	350	....	890	....	940
7	3·2	2,480	1·55	620	....	2,480	1·0	320	....	850	....	920
8	2·9	2,000	1·75	770	....	2,160	....	1,670	1·8	810	....	890
9	2·75	1,780	1·55	620	2·7	1,710	....	3,010	....	810	....	860
10	....	1,850	....	570	....	1,600	....	4,350	....	800	....	830
11	....	1,920	1·4	530	2·4	1,340	4·9	5,690	....	790	....	800
12	2·9	2,000	1·5	590	....	1,190	....	4,440	....	790	....	780
13	....	1,820	1·4	530	....	1,040	3·6	3,200	....	780	....	760
14	....	1,640	1·75	770	1·9	890	....	2,460	1·75	770	....	740
15	2·5	1,460	....	620	1·8	810	2·7	1,710	....	920	1·7	730
16	....	1,550	1·3	470	....	760	2·45	1,400	....	1,670	1·6	600
17	....	1,650	2·0	970	....	710	....	1,320	....	1,220	....	630
18	....	1,750	....	850	1·6	660	2·3	6,240	....	1,370	....	600
19	2·8	1,850	....	720	....	640	2·6	1,580	....	1,520	....	570
20	2·75	1,780	1·5	590	....	620	2·65	1,640	....	1,670	....	540
21	2·6	1,580	....	550	....	600	....	1,610	....	1,820	1·35	500
22	....	1,510	....	510	....	580	....	1,570	....	1,970	1·47	570
23	....	1,370	1·3	470	1·45	560	....	1,550	....	2,120	....	560
24	....	1,240	1·3	470	....	520	....	1,520	3·1	2,310	....	550
25	....	1,100	1·2	420	....	480	....	1,500	....	1,950	....	540
26	2·0	970	....	400	....	450	....	1,480	2·6	1,580	1·4	530
27	....	1,000	1·1	370	1·2	420	2·5	1,460	....	1,530	....	520
28	2·05	1,020	....	360	....	400	2·2	1,150	....	1,480	....	510
29	....	960	....	350	....	390	2·25	1,190	....	1,420	....	500
30	....	900	....	340	1·1	370	....	1,150	....	1,340	....	485
31	....	850	....	330	....	....	....	1,100	....	....	1·3	470

COQUITLAM RIVER.

Location.—Discharge measured at lower end of tunnel to lake Buntzen, in township 5, range 6, west of 7th meridian.

Records Available.—Average run-off from 1906 to 1913.

Winter Conditions.—Open water.

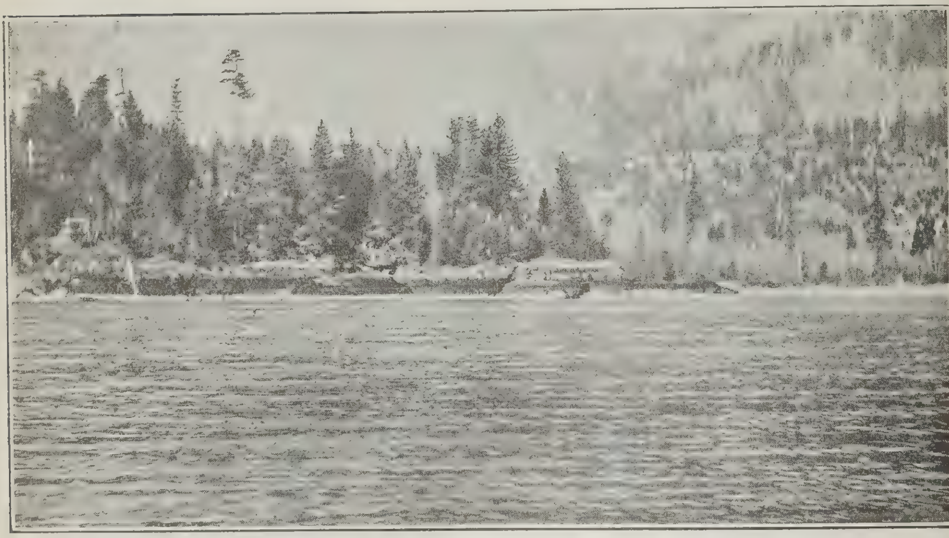
Gauge.—Staff gauge for weir measurments.

Channel.—Artificial.

Discharge Measurements.—Weir measurements made by engineers of Vancouver Power Company.

COQUITLAM RIVER.

Coquitlam river rises in Disappointment lake near the north boundary of the Railway Belt in township 7, range 6, west of the 6th meridian. Coquitlam lake is on the river about 8 miles farther south, in township 5, range 6. It is at an elevation of 430 feet, and has an area of 2,300 acres at low water. Below Coquitlam lake the river flows south for about 10 miles and discharges into Fraser river near the mouth of Pitt river in township 38 E.C.M. Gold creek enters the river from the east below the lake, and Viola creek empties into the lake itself, also from the east. The drainage area above the outlet of the lake is 105 square miles.



Fraser River at Hope, B.C. Gauge painted on Rock face.

Coquitlam watershed is in the Coast district. The mean annual precipitation near the mouth is 60 inches. There is very little snow at the mouth, and the river rarely freezes over there. At the lake, however, the snowfall is very heavy, and the lake is frozen for several months. There the precipitation is about 140 inches, and it is probably more in the higher altitudes. Snow remains on the mountain peaks practically all summer.

The Vancouver Power Company uses the water of Coquitlam river for developing power for Vancouver, New Westminster, and vicinity. The city of New Westminster gets its water supply from Coquitlam lake, and conveys it by pipes to the city. The amount of water the city uses does not seriously

Fraser River at Hope, B.C. Looking upstream from Gauge.

affect the supply for power, but it is necessary, above all things, to keep the water clean and pure and to provide for a continuous flow under all circumstances. These conditions made it necessary to establish a Government reserve around the lake and its headwaters, and to have a Government inspecting engineer on the ground during the construction of the works for the power company.

In developing power the water is diverted from Coquitlam lake to lake Buntzen, and from there it is carried in pressure pipes to the power-house on the North Arm of Burrard inlet. Water is stored in Coquitlam lake by means of a large hydraulic-fill earth dam which is capable of raising the level of the lake 50 feet. The connection between the two lakes is made by a tunnel 12,775 feet long which passes under a mountain about 4,000 feet high. Lake Buntzen makes a good equalizing reservoir, having an area of 500 acres. It is 400 feet above sea-level. At its outlet there is a concrete dam 54 feet high and 360 feet long. The pipelines from the dam to the power-house are 1,800 feet long. The upper 800 feet of each line is a wooden stave pipe with a diameter of 54 inches, and the lower 1,000 feet is of riveted steel construction, varying in diameter from 48 inches. The power-house is at sea-level, and is built of stone with a concrete foundation. On account of the high head of 400 feet, it is possible to use the tangential type of water wheel. Pelton and Doble wheels of different capacities are used, and are direct connected to their generators.

A gauging station was maintained for a few months on the Coquitlam river just above the lake, and another on Viola creek. It was the intention to combine the results obtained at these two stations, which should give very nearly the amount of water available for power, as the other streams which flow into the lake would probably provide enough water for New Westminster. The stations were maintained as long as there was a gauge reader available. The flow is now determined by a weir which the Vancouver Power Company has installed at the outlet of the tunnel. This station does not take account of the overflow over the storage dam at the lower end of lake Coquitlam, but it is not expected that there will be much overflow except possibly during the summer freshet.

Below the dam, the stream will be practically dry most of the year, but the flow of Gold creek, which enters about a mile below the dam, will probably supply sufficient water for all necessary purposes on the lower river. A gauging station is being maintained on Gold creek to measure its flow.

Monthly Discharge of Coquitlam River at outlet of Vancouver Power Company's Tunnel for 1913.

—	Mean Discharge in Second-Feet	Run-Off. Total in acre-feet.
1913	809	575,000

FRASER RIVER.

Location.—At Hope in section 16, township 5, range 26, west of 6th meridian.

Records Available.—Continuous records since March 5, 1912.

Winter Conditions.—Open water practically all year.

Gauge.—Gauge painted on rock bluff, graduated to feet, tenths by estimation—Gauge readings daily.

Channel.—Permanent channel, deep water.

Discharge Measurements.—Mainly boat measurements, of only moderate accuracy. One float measurement at high water. Six measurements in all during 1912 and 1913 covering practically all stages.

Accuracy.—Fair only. The completion of the Kettle Valley Railroad bridge will permit of better measurement being taken during 1914.

FRASER RIVER.

Fraser river has its source in the Yellowhead pass at an elevation of 3,710 feet, and after flowing some 700 miles in a general southwesterly direction, discharges into the Pacific ocean (strait of Georgia) near New Westminster. Of its length, the lower 175 miles is within the Railway Belt. The important tributaries within the Belt are Pitt river, Stave river, Sumas river, Harrison river, Nahatlatch (or Salmon) river, Silver-Hope creek, Coquihalla river, Stein creek, and Thompson river, the last named being the largest confluent. Outside the Railway Belt there are Bridge, Chilcotin, Quesnel, Blackwater, Nechako, and Willow rivers. Near Fort George the North Fork and South Fork unite. Bear river is a tributary of the South Fork.

The drainage area of the Fraser river is about 90,000 square miles. The report of the water powers of Canada, issued by the Commission of Conservation, 1911, gives it as 91,700 square miles. The said report also gives an interesting article on the Fraser river in the chapter on British Columbia.

The drainage area of the Fraser river above Lytton (i.e., above the mouth of Thompson river) is 63,000 square miles.

The drainage area of the Fraser above the gauging station at Hope (including the Coquihalla river) is 85,600 square miles.

The Fraser is important for fishing, navigation, and lumbering. There are some millions of latent horse-power in the river, particularly in the Fraser river canyon, but it is not likely that the river will be harnessed in the near future. A company now has a project for developing power at Hell's Gate, near Yale, where the river runs through a narrow canyon, and the difference between extreme high water and low water is about 100 feet.

Fraser river is the largest stream lying wholly in British Columbia, and it has played a very important part in the development of the province. It was the discovery of gold in the bed of the Fraser river that brought large numbers of men into the country; and it was the gradual movement of the gold seekers up the valley that opened up the country and led to the building of roads and bridges. When the Canadian Pacific railway was built it followed the Fraser for 150 miles, and the Thompson, a tributary of the Fraser, for as many more. The Canadian Northern Pacific railway follows the Fraser and Thompson to Kamloops, goes up the North Thompson, strikes across the divide to the upper Fraser again, and follows it to the Yellowhead pass. The Grand Trunk Pacific follows the upper Fraser river from the Yellowhead pass for 390 miles or more. Since the railways are the most important factors in developing a country rich in natural resources, the valleys of the Fraser river and its tributaries will necessarily continue to be of great importance.

Probably the most important industry connected with the Fraser river is the fishing. Salmon of various kinds come in from the salt water in countless numbers in the fall and swarm up the Fraser river, heading for the spawning grounds on the smaller rivers and creeks. Great numbers of them are caught near the mouth of the Fraser, and large canneries are situated there; and salmon are caught on all parts of the Fraser and on all the streams that flow into it. In the winter, dried fish is the staple diet of the Fraser River Indians.

British Columbia is essentially a mountainous country, and the watershed of the Fraser follows the general rule. As a result, the amount of land suitable for agriculture is relatively small. It is found mostly in small flats and benches along the Fraser and its tributaries; and sometimes a valley will widen out and give a larger expanse of good land, as in the case of the Nicola valley, where there are several townships of good land in a block. Many of the small flats

contain excellent land, and some of them in the dry belt are well sheltered and make splendid fruit land. Probably the richest land in the whole province is the delta land near the mouth of the Fraser river, of which Lulu island is a good example.

In the days of the gold rush, before the Canadian Pacific railway was built, steamers ran up the Fraser as far as Yale, which is 100 miles from the coast. During the construction of the Canadian Northern, supplies were distributed by steamer as far as Yale. But as a rule navigation on the Fraser is now confined to the 50-mile stretch from Chilliwack to the mouth. This part of the stream is tidal, and river steamers make regular trips between New Westminster and Chilliwack, calling at many points on both sides of the river on the way. But the construction of railways and electric lines is rendering the river transportation less important than formerly.

On the other hand, the importance of the Fraser river as a port for ocean shipping is increasing. In the early days, New Westminster was the only port on the mainland, and there was sufficient water over the bar for the ships of those days. But with the coming of the Canadian Pacific railway to Burrard inlet and the increase in the draught of ocean-going vessels, the Fraser river became of secondary importance. Now, however, jetties are being built at the mouth of the river so that the stream will keep its channel scoured clean, and dredging is being done where necessary. In Burrard inlet, most of the suitable waterfront is in use, and all of it is held at high prices; while along the Fraser river there are miles of good waterfront lying idle. New Westminster is starting on an extensive harbour development programme, and intends to improve the waterfront along the city and to build docks on Annacis island. The Canadian Northern railway is planning a town at Port Mann where for two or more miles there is deep water close to the shore. An industrial city seems to be starting around the Canadian Pacific railway yards at Coquitlam, and harbour surveys are being made along the Fraser and Pitt rivers. It is probable the Fraser will develop into a fresh-water harbour of considerable importance.

Lumbering is one of the chief industries of British Columbia, and there is a good deal of timber in the Fraser river watershed. The best timber is near the coast, where fir and cedar grow to immense sizes, but most of the watershed is covered with timber of some kind. In the dry belt the lower benches are often bare, but there are generally trees on the hills. In the mountains there are trees on the lower hills, though the higher peaks may rise above the timberline. In the Cariboo district, there has been cut only what timber was required for local use. The same is practically true of the dry belt. But at the coast, in addition to supplying the large local demand, a great deal of timber is shipped by rail to the prairie, and by water to Australia, South America, and the Orient. The longest sizes of cedar poles are sent by rail even as far as Ontario. The logs are floated to navigable water, where they are made into rafts and towed to the mills. There are several mills on the Fraser river, and one of them is said to be the largest in the world; but a good deal of timber they use is cut outside the Fraser watershed. Up to the present the timber which has been cut is that in the lower parts of the valleys, where it has been within easy reach of the water. But before long it will be necessary to build logging railroads to the headwaters, and the cutting of the timber there, unless done under careful supervision, with provision for reforestation, will affect the regimen of the streams.

There are no very good power sites on the Fraser river inside the Railway Belt, though many of its tributaries have excellent ones. There are no falls on the river and no very heavy rapids. There are places in the canyon where 30 or 40 feet of head could be obtained by means of a dam. But there is a railroad on each side of the river, not far above the high-water line as it is at present, and it would be found very difficult to take care of the heavy flood discharge in the narrow canyon.

Outside the Railway Belt, there is not much better chance of developing power on the Fraser. Between Lillooet and Soda creek, a distance of some 120 miles, there is a drop of about 800 feet, but there is no very heavy fall at any one point. From Soda creek to Fort George and From Fort George to Tete Jaune Cache the river can be navigated at certain seasons, though there are a few places where power might be developed by means of a dam. The upper stretch was used only during the construction of the Grand Trunk Pacific railway, and now that the railway has been completed the boats will probably not be used much. Between Fort George and Soda Creek, however, boats have been running for a number of years. The completion of the Grand Trunk Pacific railway will probably considerably lessen the traffic, but the route will be used until the completion of the section of the Pacific Great Eastern railway between Lillooet and Fort George. Though the completion of these railways will probably result in the cessation of navigation on the river, the presence of the railways along the banks of the river will be a great hindrance to the development of power in most places. The difficulty of handling the big floods and the necessity of providing proper passes for the salmon and other fish will also prove deterrent factors. British Columbia is so well supplied with good development sites with moderate flows under relatively high heads that it is very doubtful if low head propositions such as the Fraser presents, would be economically feasible.

The Fraser river empties into the gulf of Georgia, and at the mouth it rises and falls with the tides; and this tidal influence extends up the river with diminishing effect until it becomes almost negligible at Agassiz, 70 miles from the mouth. The tide rises several feet in Pitt river and Pitt lake. Hence during ordinary stages of the Fraser, there is quite a current upstream past New Westminster when the tide is rising. This is of importance for navigation, and for water supply and sewage disposal.

At New Westminster the Fraser presents quite an imposing appearance, being more than half a mile in width and, in the main channel, about 40 feet deep. In addition to the ordinary flow of the stream there is the ebb and flow of the tidal water. Near Hope, 90 miles from the mouth, the river varies from 700 to 1,000 feet in width, is 40 feet deep, in places, at low water, and at high water rises 20 feet above the low-water mark. The maximum discharge in 1913 was 450,000, the minimum 13,400, and the mean for the year about 92,000 cubic feet per second. At Yale, 100 miles from the mouth, the canyon begins, and the river is confined between solid rock walls. In many places it is only two or three hundred feet wide, and varies in depth at low water from 20 to 80 feet. During the flood it sometimes rises in certain confined parts of the canyon as much as 100 feet above the low-water mark. This canyon extends for about 30 miles, and is awe-inspring in its rugged grandeur. Above the canyon the banks are still high, but the rock is not so much in evidence. At Lytton, 150 miles from the mouth, the Thompson river enters, and above the mouth of the Thompson, the Fraser is from 300 to 700 feet wide, 15 feet deep at low water and at high water rises 25 feet above the low-water mark. The maximum discharge for 1913, 182,000, the minimum 1,500, and the mean 56,770 cubic feet per second.

The Fraser river is about 700 miles long and has a drainage area of 90,000 square miles. It rises near the summit of the Yellowhead pass, which has an altitude of 3,710 feet above the sea-level. Near Tête Jaune Cache, 50 miles from the summit, the altitude is 2,400 feet. Between that point and Fort George the stream is navigable during high water. The altitude at this later point is 1,900—a descent of 550 feet in about 200 miles. Near Fort George the Fraser river turns south. Steamers make regular trips on the 120-mile stretch between Fort George and Soda creek. At Lillooet, 130 miles farther south, the elevation is 665 feet. Near Lytton, 50 miles from Lillooet, the mean elevation is about 450 feet. Yale is 53 miles below Lytton, and the mean elevation of the water

at the average height is 170 feet. At Hope, 13 miles south of Yale,the Fraser begins to turn in a westerly direction; its elevation is about 125 feet. From Agassiz, 19 miles below Hope the course is almost directly West to the gulf of Georgia. The elevation of the river at Agassiz is about 60 feet. For the last 50 miles from Chilliwack to the mouth of the stream is affected more or less by the tides.

There are at present two gauging stations on the Fraser river. One is at Lytton, just above the mouth of the Thompson river, and is to give the flow of the upper Fraser river. The other was established at Hope, and gives practically the whole flow of the stream. The aim was to have the station as near the mouth as possible and still avoid all tidal influences.

The gauging station at Hope was established on March 1, 1912, and continuous records have been kept ever since. It is below the mouth of the Coquihalla river. The original gauge was painted on the smooth face of the rocky point where the Kettle Valley Railway bridge has been built. A vertical staff gauge has since been attached to the east face of the east pier. These gauges give the same reading and are referred to bench-marks on both sides of the river.

Before the construction of the bridge, it was quite difficult to get good meter measurements at the higher stages. It was not considered advisable to erect an expensive cable station, particularly as the construction of the bridge might render it unnecessary. At the lower stages a boat could be anchored in the stream and its position determined by triangulation from the shore. At higher stages a motor-boat was used for several stages but it was sometimes difficult to get the anchor to hold the boat or the section, even with the help of the engine. An attempt to put in permanent anchors and buoys failed on account of the swift current. Two measurements were made from the ferry cable at Yale, 10 miles farther up the river, but one float measurement was made at Hope. Taken together, the measurements gave a fair curve, but now that the bridge has been built probably better results can be obtained in 1914. It is quite possible that the construction of the bridge piers may have materially affected the rating of the gauge, but that will be determined during 1914, and a new curve constructed if necessary.

The gauging station near Lytton is at the ferry crossing, about 2 miles from the town. The gauge is painted on an irregular rock point. Meter measurements are made from the ferry boat, which is held against the current by the ferry cable and kept in its proper position as nearly as possible by the steering oar. The distance from the shore is measured by triangulation.

In 1914 it is proposed to establish a new station at the Pacific Great Eastern Railway trestle, near Lillooet. This station is to be used in connection with the one on the Thompson river at Spences Bridge for estimating the Fraser river floods.

Discharge Measurements of Fraser River near Hope, 1912–13.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
1912.							
March 5	C. G. Cline	1,046	690	14,405	1·27	10·0	[1]18,280
June 6	B. Corbould	1,046	1,000	19,835	6·80	21·0	135,704
" 28	C. G. Cline	1,046	710	26,500	8·49	24·5	[2]225,000
Sept. 26	do	1,046	575	12,500	5·90	14·0	73,400
" 24	do	1,046	885	17,200	4·00	14·7	[3]69,947
1913.							
June 21	K. G. Chisholm	1,046	1,016	27,100	10·20	26·0	[4]278,000

Note.—[1] Section at gauge. [2] Measured at Yale. [3] Section above gauge. [4] Float measurement.

MONTHLY DISCHARGE of Fraser River near Hope for 1912.

(Drainage area, 85,600 square miles.)

Month.	Discharge in Second-Feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
March	19,500	14,200	16,150	0·19	0·22	990,000
April	69,500	19,500	40,720	0·48	0·54	2,420,000
May	217,600	68,000	150,000	1·75	2·02	9,223,000
June	246,000	139,200	186,000	2·17	2·42	11,070,000
July	191,800	114,000	136,000	1·59	1·83	8,362,000
August	123,800	97,000	113,000	1·32	1·52	6,948,000
September	91,000	52,000	70,170	0·80	0·92	4,177,000
October	68,000	44,000	53,000	0·63	0·73	3,308,000
November	45,000	33,000	39,300	0·46	0·51	2,339,000
December	32,000	24,000	27,800	0·32	0·37	1,709,000

MONTHLY DISCHARGE of Fraser River near Hope for 1913.

(Drainage area, 85,600 square miles.)

Month.	Discharge in Second-Feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
January	25,000	13,400	17,800	0·21	0·24	1,093,000
February	44,000	18,000	25,300	0·30	0·31	1,401,000
March	24,000	17,400	19,000	0·22	0·26	1,169,000
April	65,500	17,400	34,400	0·40	0·45	2,040,000
May	162,000	34,000	82,300	0·96	1·11	5,053,000
June	450,000	173,000	306,800	3·58	3·99	18,227,000
July	289,400	167,000	201,000	2·35	2·71	12,355,000
August	203,000	153,000	177,000	2·07	2·39	10,910,000
September	160,000	80,000	113,900	1·33	1·48	6,767,000
October	78,000	51,000	60,300	0·70	0·81	3,710,000
November	56,000	29,000	37,200	0·43	0·48	2,210,000
December	....	....	27,000	0·32	0·37	1,657,000[1]
Th ar	450,000	13,400	92,120	1·07	14·60	66,592,000

NOTE.—Accuracy "C".
[1] Est'd.

Daily Gauge Heights and Discharges of Fraser River near Hope for 1912.

Day.	March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	16,000	10·2	19,500	14·9	68,000	23·0	184,000
2	....	16,000	10·7	24,000	15·2	71,500	23·0	184,000
3	....	16,000	10·5	22,100	16·0	80,000	22·7	177,400
4	....	16,000	10·7	24,000	16·7	87,500	22·0	182,000
5	....	16,000	10·7	24,000	17·0	91,000	21·5	153,000
6	10·0	18,000	10·7	24,000	17·3	95,000	21·0	144,000
7	9·7	16,200	10·9	26,000	17·6	98,000	20·8	140,800
8	9·7	16,200	11·0	27,000	18·0	103,000	20·9	142,400
9	9·6	15,700	11·1	28,000	18·5	109,000	20·7	139,200
10	9·6	15,700	11·2	29,000	18·9	113,400	20·7	139,200
11	9·6	15,700	11·2	29,000	19·2	115,800	20·8	140,800
12	9·6	15,700	11·5	32,000	19·7	123,800	21·2	148,000
13	9·6	15,700	11·6	33,000	19·9	126,600	21·7	157,000
14	9·5	15,200	11·7	34,000	19·9	126,600	21·9	160,200
15	9·4	14,700	11·9	36,000	20·1	129,700	22·0	162,000
16	9·5	15,200	12·0	37,000	21·7	157,000	22·8	179,600
17	9·6	15,700	12·7	44,000	21·7	157,000	23·0	184,000
18	9·7	16,200	12·5	42,000	22·0	162,000	23·7	203,000
19	9·7	16,200	12·7	44,000	23·5	197,000	23·5	197,000
20	9·6	15,700	13·0	47,000	23·6	200,000	23·8	206,000
21	9·7	16,200	13·2	49,000	23·7	203,000	24·2	217,600
22	9·6	15,700	13·5	52,000	23·5	197,000	24·9	237,200
23	9·5	15,200	13·8	56,000	22·8	179,600	25·1	243,400
24	9·5	15,200	14·0	58,000	23·2	189,200	25·2	246,800
25	9·3	14,200	14·0	58,000	24·0	212,000	25·2	246,800
26	9·7	16,200	14·1	59,000	24·1	214,800	24·8	234,400
27	9·8	16,800	14·5	63,000	24·2	217,600	24·5	226,000
28	10·1	18,700	14·7	65,500	24·0	212,000	24·5	226,000
29	10·2	19,500	14·8	66,500	24·0	212,000	24·0	212,000
30	10·0	18,000	15·0	69,000	23·7	203,000	23·5	197,000
31	9·9	17,400	....	....	23·5	197,000	....	....

DAILY GAUGE HEIGHTS AND DISCHARGES of Fraser River near Hope, for 1912—*Concluded.*

Day.	July		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge	Gauge Height.	Discharge.	Gauge Height.	Discharge	Gauge Height.	Discharge	Gauge Height.	Discharge	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	23·3	191,800	18·9	113,400	17·0	91,000	13·3	50,000	12·6	43,000	11·4	31,000
2	23·0	184,000	18·8	112,300	16·7	87,500	13·5	52,000	12·5	42,000	11·5	32,000
3	22·7	177,400	18·8	112,300	16·7	87,500	13·5	52,000	12·4	41,000	11·3	30,000
4	21·3	150,000	18·9	113,400	16·5	85,000	13·2	49,000	12·2	39,000	11·4	31,000
5	21·9	160,200	19·1	115,400	16·0	80,000	13·0	47,000	12·1	38,000	11·5	32,000
6	21·1	146,000	19·1	115,400	15·9	79,000	13·5	52,000	12·0	37,000	11·3	30,000
7	20·9	142,400	19·0	114,000	15·8	78,000	14·0	58,000	12·2	39,000	11·4	31,000
8	20·9	142,400	18·9	113,400	15·7	77,000	14·9	68,000	12·1	38,000	11·2	29,000
9	20·8	140,800	19·0	114,000	15·7	77,000	14·3	61,000	12·2	39,000	11·0	27,000
10	20·8	140,800	19·1	115,400	15·5	75,000	14·2	60,000	12·2	39,000	11·0	27,000
11	20·5	136,000	18·9	113,400	15·7	77,000	14·1	59,000	12·1	38,000	11·1	28,000
12	20·0	128,000	18·9	113,400	15·5	75,000	14·2	60,000	12·0	37,000	11·2	29,000
13	20·2	131,400	19·0	114,000	15·6	76,000	14·2	60,000	12·8	45,000	11·4	31,000
14	20·2	131,400	19·5	121,000	15·2	71,500	14·0	58,000	12·4	41,000	11·4	31,000
15	20·3	133,100	19·5	121,000	14·9	68,000	14·0	58,000	12·2	39,000	11·2	29,000
16	20·8	140,800	19·3	118,200	15·0	69,000	13·8	56,000	12·2	39,000	11·1	28,000
17	20·5	136,000	18·7	112,000	15·0	69,000	14·0	58,000	11·9	36,000	10·9	26,000
18	20·1	129,700	18·5	109,000	15·0	69,000	13·8	56,000	12·1	38,000	10·9	26,000
19	19·9	126,600	18·5	109,000	14·9	68,000	13·7	54,500	12·9	45,000	10·8	25,000
20	19·8	125,800	18·7	111,200	14·8	66,500	13·7	54,500	12·4	41,000	10·7	24,000
21	19·7	123,800	18·7	112,200	14·8	66,500	13·8	56,000	12·2	39,000	10·7	24,000
22	19·6	122,400	18·7	111,200	14·7	65,500	13·5	52,000	12·5	42,000	10·7	24,000
23	19·7	123,800	18·7	111,200	14·5	63,000	13·5	52,000	12·8	45,000	10·8	25,000
24	19·5	121,000	18·9	113,400	14·4	62,000	13·3	50,000	12·7	44,000	10·9	26,000
25	19·7	123,800	19·1	115,400	14·2	60,000	13·3	50,000	12·4	41,000	10·8	25,000
26	19·8	125,200	19·7	123,800	14·0	58,000	13·3	50,000	11·9	36,000	11·0	27,000
27	19·8	125,200	19·7	123,800	14·0	58,000	13·0	47,000	11·8	35,000	10·7	24,000
28	19·5	121,000	19·3	118,200	14·0	58,000	12·8	45,000	11·8	35,000	10·9	26,000
29	19·1	115,400	18·0	103,000	13·8	56,000	13·0	47,000	11·7	34,000	11·0	27,000
30	19·0	114,000	17·9	101,500	13·5	52,000	12·9	46,000	11·6	33,000	11·1	28,000
31	19·1	115,400	17·5	97,000	....	....	12·7	44,000	....	....	11·2	29,000

Daily Gauge Heights and Discharges of Fraser River near Hope for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	10·7	24,000	10·0	18,000	10·0	18,000	9·9	17,400	12·6	43,000	22·5	173,000
2	10·8	25,000	10·5	22,100	10·1	18,700	9·9	17,400	12·3	40,000	23·8	206,000
3	10·7	24,000	11·1	28,000	10·3	20,300	9·9	17,400	12·1	38,000	24·7	231,600
4	10·8	25,000	11·2	29,000	10·0	18,000	9·9	17,400	12·0	37,000	25·5	257,000
5	10·2	19,500	11·5	32,000	10·2	19,500	10·0	18,000	11·8	35,000	25·0	240,000
6	10·2	19,500	12·7	44,000	10·7	24,000	10·0	18,000	11·7	34,000	24·1	214,800
7	10·2	19,500	12·0	37,000	10·3	20,300	10·0	18,000	11·7	34,000	24·3	220,400
8	10·7	24,000	11·3	30,000	10·3	20,300	10·0	18,000	11·8	35,000	24·7	231,600
9	9·8	16,800	11·0	27,000	10·3	20,300	10·1	18,700	12·0	37,000	24·9	237,200
10	10·0	18,000	10·8	25,000	10·3	20,300	10·1	18,700	12·4	41,000	26·0	274,000
11	9·9	17,400	10·7	24,000	10·2	19,500	10·2	19,500	12·7	44,000	27·4	326,000
12	10·0	18,000	10·6	23,000	10·2	19,500	10·5	22,100	13·2	49,000	28·5	375,000
13	9·1	13,400	10·5	22,100	10·2	19,500	10·5	22,100	14·7	65,500	29·0	400,000
14	9·3	14,200	10·2	19,500	10·2	19,500	10·6	23,000	15·6	76,000	30·2	450,000
15	9·3	14,200	10·4	21,200	10·2	19,500	10·9	26,000	16·0	80,000	30·2	450,000
16	9·5	15,200	10·5	22,100	10·2	19,500	11·2	29,000	16·3	83,000	29·6	430,000
17	9·5	15,200	11·1	28,000	10·2	19,500	12·0	37,000	16·7	87,500	29·1	405,000
18	9·4	14,700	11·1	28,000	10·0	18,000	11·9	36,000	16·7	87,500	28·3	365,000
19	9·4	14,700	10·7	24,000	10·3	20,300	12·6	43,000	16·8	88,500	27·7	338,600
20	9·5	15,200	10·7	24,000	10·3	20,300	13·0	47,000	16·8	88,500	27·2	318,000
21	9·7	16,200	10·5	22,100	10·2	19,500	13·4	51,000	17·0	91,000	26·7	299,200
22	9·7	16,200	10·7	24,000	10·1	18,700	13·7	54,500	17·2	93,500	26·4	289,400
23	10·0	18,000	10·5	22,100	10·0	18,000	14·0	58,000	18·4	107,500	26·7	299,200
24	10·1	18,700	10·7	24,000	19·9	17,400	14·7	65,500	19·2	116,800	27·1	314,000
25	10·2	19,500	10·5	22,100	9·9	17,400	14·6	64,000	19·9	126,600	27·4	326,000
26	9·8	16,800	10·5	22,100	9·9	17,400	14·5	63,000	20·7	139,200	27·2	318,000
27	9·7	16,200	10·5	22,100	9·9	17,400	13·7	54,500	20·7	139,200	27·2	318,000
28	9·7	16,200	10·4	21,200	9·9	17,400	13·0	47,000	20·9	142,400	26·8	303,800
29	9·6	15,700	....	....	9·9	17,400	12·8	45,000	21·4	151,500	26·7	299,600
30	9·6	15,700	....	....	9·9	17,400	12·7	44,000	21·8	158,700	26·6	295,600
31	9·5	15,200	....	....	9·9	17,400	....	....	22·0	162,000	....	...

DAILY GAUGE HEIGHTS AND DISCHARGES of Fraser River near Hope for 1913—*Concluded.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	26·4	289,400	22·2	167,000	21·7	157,000	15·9	78,000	13·8	56,000	[1]	27,000
2	26·2	281,200	21·7	157,000	21·3	150,000	15·7	77,000	13·5	53,500	....	27,000
3	25·8	267,200	21·5	153,000	20·9	142,000	15·5	75,000	13·3	50,000	....	27,000
4	25·7	263,900	21·5	153,000	21·9	160,000	15·3	72,500	13·1	48,000	....	27,000
5	25·3	250,200	21·6	155,000	21·2	148,000	15·1	70,000	13·1	48,000	....	27,000
6	24·9	237,200	21·7	157,000	20·4	135,000	14·0	58,000	13·0	47,000	....	27,000
7	24·3	220,000	21·8	159,000	29·8	125,000	13·8	56,000	12·0	37,000	....	27,000
8	24·0	212,000	21·8	159,000	19·5	121,000	13·7	54,500	12·0	37,000	....	27,000
9	23·7	203,000	21·9	160,000	19·2	117,000	13·5	52,000	12·0	37,000	....	27,000
10	23·7	203,000	22·9	182,000	18·5	109,000	13·4	51,000	11·9	36,000	....	27,000
11	24·0	212,000	23·7	203,000	18·2	105,000	13·5	52,000	11·8	35,000	....	27,000
12	23·7	203,000	23·7	203,000	17·7	99,000	14·0	58,000	11·8	35,000	....	27,000
13	23·3	192,000	23·4	194,000	17·4	96,000	14·3	61,000	11·8	35,000	....	27,000
14	23·0	184,000	23·2	189,000	17·7	99,000	14·1	59,000	11·7	34,000	....	27,000
15	22·8	180,000	23·2	189,000	17·8	100,500	13·8	56,000	11·7	34,000	....	27,000
16	22·6	175,000	23·0	184,000	17·5	97,000	13·8	56,000	12·5	42,000	....	27,000
17	22·3	170,000	22·9	182,000	17·7	99,000	14·0	58,000	12·0	37,000	....	27,000
18	22·3	170,000	23·1	187,000	17·9	101,500	14·2	50,000	11·9	36,000	....	27,000
19	22·3	170,000	23·1	187,000	18·2	105,000	14·0	58,000	11·9	36,000	....	27,000
20	22·3	170,000	23·2	189,000	19·3	118,000	13·9	57,000	11·9	36,000	....	27,000
21	22·4	172,000	23·3	192,000	20·7	139,000	13·8	56,000	11·9	36,000	....	27,000
22	22·4	172,000	23·4	194,000	20·3	133,000	13·8	56,000	11·5	32,000	....	27,000
23	22·6	175,000	23·4	194,000	19·0	114,000	13·9	57,000	11·4	31,000	....	27,000
24	22·8	180,000	23·3	192,000	18·1	104,000	14·0	58,000	11·3	30,000	....	27,000
25	23·2	189,000	23·1	187,000	17·8	100,500	14·0	58,000	11·3	30,000	....	27,000
26	23·5	197,000	22·8	180,000	17·5	97,000	14·2	60,000	11·2	29,000	....	27,000
27	23·2	189,000	22·7	177,000	17·2	93,500	14·8	66,500	11·2	29,000	....	27,000
28	23·2	189,000	22·5	173,000	16·8	88,500	14·7	65,500	11·2	29,000	....	27,000
29	23·0	184,000	22·3	170,000	16·4	84,000	14·2	60,000	11·3	30,000	....	27,000
30	22·5	173,000	22·2	167,000	16·0	80,000	13·9	57,000	....	30,000	....	27,000
31	22·2	167,000	22·1	164,000	....	....	13·9	57,000	....	....	....	27,000

[1] Estimated.

GOLD CREEK.

Location.—Near the mouth of creek in section 36, township 39, west of Coast meridian.

Records Available.—Weir measurements two or three times a week beginning July 26, 1910. Regular gauge readings from October 26, 1912, to November 30, 1913.

Winter Conditions.—Open water all year.

Gauge.—Staff gauge nailed to tree. Gauge readings daily.

Channel.—Rocky and steep, water swift at higher stages.

Discharge Measurements.—One meter measurement in 1912 and three in 1913; do not agree very well.

Accuracy.—Only fairly accurate.

GOLD CREEK.

Gold creek rises in the mountains east of lake Coquitlam at an elevation of 2,000 feet or more, and discharges into Coquitlam river below Coquitlam lake at an elevation of about 400 feet. It is part of the Fraser drainage.

The mean annual precipitation in the Gold creek watershed is probably 140 inches or more. In the winter there is a snowfall of something like 6 feet. This probably increases in the higher altitudes. Near the mouth it is not very cold, and open water conditions obtain at the gauging station. In the higher altitudes the winters are more severe.

Float measurements were taken three or four times a week by Mr. R. S. Stronach during his inspection of the construction work at lake Coquitlam. These records are continuous from July 26, 1910, to October 20, 1912. On October 26, a regular gauging station was established. The records were kept until November 30, 1913. All these measurements were taken near the mouth of the creek. The purpose is to show, if possible, that there is sufficient flow in Gold creek to satisfy all the ordinary demands of the riparian owners on the Coquitlam river below the dam. If this is found to be the case, there will be no necessity for the Vancouver Power Company to allow any water to pass through the dam at lake Coquitlam, and the total flow can be stored for use in the power plant.

Discharge Measurements of Gold Creek at 1 mile from Mouth, for 1912–13.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
1912.							
Oct. 26	C. G. Cline	1,046	34	47	2·6	3·70	124·0
1913.							
June 11	C. G. Cline	1,044	28	42	2·5	3·52	107·0
July 18	K. G. Chisholm	1,055	32	47	2·6	3·45	119·0
Oct. 17	H. J. E. Keys	1,057	35	26	2·0	3·10	53·7

Monthly Discharge of Gold Creek at 1 mile from mouth for 1913.

Month.	Discharge in Second-Feet.			Run-off.
	Maximum.	Minimum.	Mean.	Total in acre-feet.
January	96	4	48·8	3,000
February	390	18	62·1	3,450
March	215	18	57·7	3,550
April	142	25	91·5	5,450
May	245	33	130·0	8,009
June	170	96	123·2	7,320
July	163	33	84·3	5,180
August	142	9	24·1	1,480
September	200	8	40·5	2,410
October	500	9	63·5	3,900
November	530	21	117·9	7,020

Note.—Accuracy "C" and "D".

Daily Gauge Heights and Discharges of Gold Creek for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	3·45	96	2·85	29	2·70	18	2·90	33	3·10	54	3·85	149
2	3·40	90	2·83	27	2·70	18	2·80	25	3·05	48	4·00	170
3	3·38	88	2·82	26	2·80	25	2·90	33	3·05	48	3·95	163
4	3·35	84	2·80	25	2·90	33	3·00	42	3·00	42	3·75	135
5	3·00	42	2·79	24	3·10	54	3·10	54	2·90	33	3·55	108
6	2·50	9	2·78	23	3·20	66	3·20	66	3·15	60	3·60	115
7	2·48	8	2·76	22	3·30	78	3·20	66	3·35	84	3·75	135
8	2·30	5	2·74	21	3·35	84	3·30	78	3·75	135	3·80	142
9	2·29	5	2·74	21	3·30	78	3·35	84	3·90	156	3·60	115
10	2·27	4	2·74	21	3·25	72	3·50	102	4·20	200	3·60	115
11	2·27	4	2·73	20	3·20	66	3·65	121	4·50	245	3·52	105
12	2·25	4	2·73	20	3·10	54	3·80	142	4·20	200	3·55	108
13	2·25	4	2·73	20	3·00	42	3·70	128	3·90	156	3·50	102
14	2·35	5	2·95	37	2·95	37	3·65	121	3·80	142	3·55	108
15	2·50	9	3·44	95	2·90	33	3·50	102	3·75	135	3·60	115
16	2·75	21	5·50	390	3·60	115	3·40	90	3·70	128	3·60	115
17	3·10	54	5·30	360	4·30	215	3·40	90	3·50	102	3·45	96
18	3·35	84	3·60	115	3·50	102	3·45	96	3·60	115	3·50	102
19	3·33	82	3·40	90	3·40	90	3·55	108	3·80	128	3·80	142
20	3·32	81	3·30	78	3·30	78	3·60	115	3·60	115	3·85	149
21	3·32	81	3·10	54	3·00	42	4·00	170	3·50	102	3·85	149
22	3·30	78	3·00	42	2·90	33	3·60	115	3·60	115	3·75	135
23	3·29	77	2·90	33	2·80	25	3·40	90	3·70	128	3·60	115
24	3·29	77	2·90	33	2·80	25	3·30	78	3·80	142	3·55	108
25	3·29	77	2·90	33	2·70	18	3·75	135	3·95	163	3·50	102
26	3·30	78	2·90	33	2·70	18	3·90	156	4·20	200	3·50	102
27	3·25	72	2·85	29	2·75	21	3·50	102	4·40	230	3·65	108
28	3·20	66	2·70	18	2·90	33	3·35	84	4·15	192	3·60	115
29	3·10	54	....	....	....	108	3·20	66	3·90	156	3·50	102
30	3·00	42	....	....	3·10	54	3·10	54	3·80	142	4·00	170
31	2·90	33	....	....	3·00	42	....	....	3·70	128	....	....

DAILY GAUGE HEIGHTS AND DISCHARGES of Gold Creek for 1913—*Con.*

Day.	July.		August.		September.		October.		November.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	3·80	142	2·90	33	2·48	8	2·60	13	2·95	37
2	3·60	115	2·85	29	2·48	8	2·55	11	2·80	25
3	3·50	102	2·80	25	4·10	185	2·55	11	2·75	21
4	3·50	102	2·78	26	4·20	200	2·55	11	2·95	37
5	3·45	96	2·72	20	3·70	128	2·50	9	3·80	142
6	3·45	96	2·67	17	3·30	78	2·45	7	3·70	128
7	3·45	96	2·64	15	3·10	54	2·80	25	3·30	78
8	3·50	102	2·62	14	3·20	66	2·80	25	3·45	98
9	3·65	122	2·60	13	3·15	60	2·70	18	3·60	115
10	3·95	163	2·57	12	3·05	48	3·10	54	3·50	102
11	3·75	135	2·55	11	2·90	33	4·60	260	3·35	84
12	3·40	90	2·82	27	2·80	25	4·30	500	3·05	48
13	3·35	84	2·61	13	2·75	21	4·00	170	2·95	37
14	3·30	78	3·20	66	2·70	18	3·40	90	2·90	33
15	3·25	72	2·90	33	2·65	15	3·50	102	3·00	42
16	3·25	72	2·68	17	2·75	22	3·30	78	5·00	315
17	3·25	72	2·80	25	2·70	18	3·10	54	3·50	102
18	3·30	78	3·80	142	2·65	15	3·10	54	3·40	90
19	3·45	96	3·15	60	2·60	13	3·20	66	3·60	115
20	3·45	96	2·85	29	2·55	11	3·10	54	3·40	90
21	3·45	96	2·60	13	2·70	18	3·05	48	3·10	54
22	3·40	90	2·58	12	2·65	15	2·95	38	3·10	54
23	3·30	78	2·64	15	2·60	13	3·00	42	3·10	54
24	3·20	66	2·60	13	2·60	13	3·20	66	6·50	530
25	3·10	54	2·55	11	2·55	11	2·95	37	5·50	390
26	3·05	48	2·50	9	2·52	10	2·85	29	3·90	156
27	3·00	42	2·55	11	2·55	11	2·80	25	4·00	170
28	2·95	37	2·53	10	3·10	54	2·75	22	3·70	128
29	2·90	33	2·51	9	2·85	29	2·80	18	4·00	170
30	2·90	33	2·50	9	2·65	15	2·65	15	3·50	102
31	2·90	33	2·49	9	....	....	2·70	18	....	....

HIXON CREEK NEAR MOUTH.

Location—Section 34, township 6, range 7, west of 7th meridian.

Records Available.—Continuous records since November, 1912.

Winter Conditions.—Open water all year.

Gauge.—Vertical staff gauge-readings generally four or five a week. Bed of stream scoured out about November 13, 1912, changing rating of gauge. Gauge was finally washed out and new one installed at a different section, September 24, 1913.

Channel.—Rocky, water swift at higher stages.

Discharge Measurements.—One in 1912 for gauge No. 1A; eight in 1913 for gauge No. 1; four in 1913 for gauge No. 2.

Accuracy.—Only moderate accuracy on account of changes. Gauge No. 2 should give accurate results when more fully rated.

HIXON CREEK.

Hixon creek has its source in the mountains northeast of Burrard inlet, at an elevation of about 3,000 feet, and discharges into the Mesliloet river at about 5 miles from the mouth, at an elevation of some 200 feet. It is part of Burrard inlet drainage. The more important tributaries are Belknap creek and Barnes creek, both entering from the north.

The rainfall in the Hixon creek watershed is quite heavy, being probably from 120 to 150 inches. In the winter there is from 2 to 6 feet of snow. In the higher altitudes there are snowfields which remain most of the year. At the mouth of the river the stream is open all the year round, and above Belknap lake there is very little ice, so that open-water conditions exist there too.

The Westminster Power Company may use some of the water from Hixon creek in connection with their high-head development. The latest plan includes the diversion of water from Belknap creek, which is a tributary of Hixon creek, and its storage in Norton lake. It may be possible also to convey water from the main branch of Hixon creek above Belknap creek into the same reservoir. From Norton lake the main pipe-line would lead to the power-house situated near the mouth of Brandt creek. An alternative scheme would provide for a pipe-line down Hixon creek, collecting water from Hixon creek and Belknap lake. This pipe-line, however, would be at a lower elevation than Norton lake, and could not be connected directly to the main penstocks.

Gauging stations have been established at the mouth of Hixon creek and at Hixon creek above Belknap creek. It was hoped that the station at the mouth of the stream might be used to give some idea of the flow higher up the stream, but this has been found impracticable, and the lower station will probably be abandoned as soon as facilities are provided for taking more frequent gauge readings on the upper stations. There are two stations also on Belknap creek, which is a tributary of Hixon creek.

DISCHARGE MEASUREMENTS of Hixon Creek near Mouth, 1912 and 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1912.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Oct. 19	C. G. Cline	1,046	18	35·0	2·04	2·00	[1]71·5
1913.							
June 1	H. C. Hughes	1,673	36	63·0	5·37	1·80	[2]339·0
" 5	do	1,673	36	52·1	4·67	1·48	244·0
" 7	do	1,673	36	56·1	4·80	1·60	270·0
" 14	do	1,673	35	45·1	4·35	1·30	196·5
" 18	do	1,673	34	40·8	4·32	1·25	176·5
" 27	do	1,673	34	46·5	4·55	1·40	212·0
July 18	do	1,673	28	26·6	5·63	1·02	[3]150·0
Aug. 4	do	1,673	28	23·0	4·52	0·69	104·0
Sept. 24	F. MacLachlan	1,673	48	27·4	1·21	3·79	[4]33·2
Oct. 18	do	1,673	54	44·5	1·64	4·34	72·5
" 31	do	1,673	51	31·5	1·15	3·89	36·3
Nov. 5	do	1,521	56	53·4	2·27	4·59	121·0

NOTE.—[1]Gauge No. 1A.
[2] Gauge No. 2.
[3] Different Section.
[4] Different Gauge No 2.

MONTHLY DISCHARGE of Hixon Creek near Mouth for 1913.

Month.	Discharge in Second-Feet.			Run-Off.
	Maximum.	Minimum.	Mean.	Total in acre-feet.
January	70	53	66·8	4,100
February	121	20	52·7	2,920
March	82	53	66·9	4,110
April	166	59	104·6	6,200
May	675	75	246·3	15,100
June	525	175	273·5	16,300
July	344	95	178·0	10,900
August	142	70	90·2	5,550
September	167	34	59·8	3,560
October	661	31	104·0	6,400
November	702	40	166·5	9,880
December	200	37	84·6	5,200
The year	702	20	124·5	90,200

NOTE.—Accuracy "A' and "C".

MONTHY DISCHARGE of Hixon Creek near Mouth for 1912.

Month.	Discharge in Second-Feet.			Run-Off.
	Maximum.	Minimum.	Mean.	Total in acre-feet.
November	570	66	149	8,870
December	110	60	69	4,240

NOTE.—Accuracy "A" and "C' .

Daily Gauge Heights and Discharges of Hixon Creek near Mouth for 1912.

Day.	October. Gauge Height.	October. Discharge.	November. Gauge Height.	November. Discharge.	December. Gauge Height.	December. Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1			1·7	66	......	74
2			1·9	70	0·25	74
3			2·15	75	......	70
4				100	0·1	67
5			2·85	124	......	62
6			......	108	−0·25	57
7			2·55	92	......	60
8			......	100	−0·03	63
9			......	106	......	66
10			......	114	......	70
11			......	122	......	73
12			2·9	130	0·3	76
13			Gauge No. 1	180	0·25	74
14			1·45	231	0·75	110
15			1·25	185	......	92
16			1·05	150	0·25	74
17	Gauge		......	150	0·1	67
18	No. 1A		......	150	0·5	87
19	2·0	72	......	150	0·2	71
20	......	70	1·05	150	0·05	56
21	1·85	69	2·35	570	......	64
22	......	72	......	430	−0·03	63
23	......	75	......	290	......	63
24	......	78	1·05	150	......	63
25	......	81	0·6	95	......	63
26	......	85	......	85	−0·03	63
27	2·5	88	0·3	76	0·2	71
28	......	84	0·2	71	0·05	66
29	......	80	......	72	......	64
30	......	75	......	73	......	62
31	......	70	......	......	......	60

Daily Gauge Heights and Discharges of Hixon Creek near Mouth for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	0·0	70	....	64	....	53	−0·35	61	0·3	79	1·8	344
2	....	70	....	58	....	56	−0·4	59	....	77	2·0	420
3	0·0	70	....	52	....	59	−0·1	68	0·2	76	....	380
4	....	70	....	46	....	62	....	72	....	76	....	320
5	....	69	....	40	−0·2	65	0·2	76	0·15	75	1·5	245
6	....	68	....	34	....	69	....	73	....	101	....	260
7	....	67	−1·4	27	....	73	0·0	70	0·9	127	1·6	275
8	....	66	....	25	0·2	76	....	78	1·5	186	....	250
9	−0·2	65	....	24	....	74	....	86	1·5	245	1·45	232
10	....	66	....	22	0·1	73	0·6	95	....	255	....	236
11	....	68	−1·6	20	....	73	1·05	150	....	265	....	240
12	0·0	70	....	20	0·1	73	1·15	166	1·6	275	1·5	245
13	....	70	....	20	−0·1	68	....	151	....	265	1·55	260
14	....	70	....	20	....	71	....	136	....	255	1·3	194
15	0·0	70	....	45	....	74	0·85	121	1·5	245	....	234
16	....	70	....	70	....	77	....	108	0·9	127	1·6	275
17	....	70	....	95	....	80	0·6	95	0·9	127	1·2	175
18	....	70	0·85	121	0·35	82	1·0	142	0·95	134	1·25	185
19	....	70	....	100	....	72	....	142	....	154	....	250
20	....	70	0·35	82	−0·3	62	1·0	142	1·2	175	1·7	308
21	....	70	....	77	....	62	....	129	1·15	166	2·25	525
22	0·0	70	0·1	73	....	61	0·8	116	1·3	194	....	400
23	....	65	....	66	−0·35	61	....	102	1·5	245	1·6	275
24	....	60	−0·4	59	−0·5	56	0·5	88	1·5	245	....	265
25	....	56	....	57	−0·5	56	0·55	92	....	420	....	255
26	−0·6	53	....	55	....	59	....	99	2·45	610	1·5	245
27	....	57	−0·6	53	....	62	....	108	2·6	675	1·4	218
28	....	60	−0·7	50	....	65	0·8	116	....	575	....	218
29	....	64	....	....	−0·1	68	....	104	....	470	1·4	218
30	....	67	....	....	....	66	....	92	1·85	362	....	208
31	0·0	70	....	....	....	64	....	....	....	354	....	....

Daily Gauge Heights and Discharges of Hixon Creek near Mouth for 1913.—*Con.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	197	0·65	100	0·00	70	....	64	....	40	4·45	93
2	....	186	0·67	102	0·05	72	....	53	4·0	44	4·35	77
3	1·2	175	....	103	....	72	....	42	....	70	4·25	64
4	1·25	185	0·69	104	Gauge washed out	771	3·7	32	....	95	....	64
5	1·3	194	0·6	95		70	3·65	31	4·59	121	....	64
6	....	270	0·55	92	....	69	3·65	31	4·55	113	4·25	64
7	1·8	344	0·5	88	....	68	3·7	32	4·3	70	4·45	83
8	1·3	194	0·5	88	....	67	....	32	....	75	4·23	62
9	....	245	0·45	86	....	66	3·7	32	....	80	4·2	58
10	1·6	275	....	85	....	65	....	200	....	85	....	120
11	1·3	194	0·4	84	....	63	5·25	354	4·45	93	4·8	182
12	1·2	175	0·45	86	....	61	6·00	661	....	73	....	155
13	....	150	0·5	88	....	59	5·25	354	4·15	54	4·6	124
14	0·85	121	0·55	92	....	56	4·8	182	....	66	....	165
15	0·8	116	....	104	....	54	....	150	....	78	4·85	200
16	....	121	....	116	....	51	....	115	....	90	4·6	124
17	0·9	127	....	130	....	48	4·4	84	4·5	102	....	104
18	1·02	150	1·0	142	....	46	4·34	73	4·4	84	4·4	184
19	1·3	194	0·6	95	....	44	4·35	77	....	93	....	60
20	....	200	0·5	88	....	42	....	69	4·5	102	4·1	55
21	....	206	0·3	79	....	40	....	61	4·15	54	4·0	44
22	....	212	0·3	79	Gauge No. 2	38	4·15	54	....	74	....	44
23	1·4	218	0·35	79		36	....	59	4·45	93	4·0	44
24	1·3	194	0·25	78	3·78	34	4·25	64	....	400	3·85	37
25	1·2	175	0·2	76	....	35	....	59	6·1	702	....	37
26	....	155	0·2	76	....	35	....	54	....	550	3·85	37
27	....	135	....	74	3·85	37	....	49	5·4	415	....	47
28	0·8	116	0·1	73	4·75	167	....	43	....	415	4·2	58
29	0·65	100	0·05	72	4·4	84	3·85	37	5·4	415	4·1	50
30	....	98	....	71	....	74	3·75	32	....	250	....	90
31	0·6	95	0·0	70	....	....	3·89	36	....	....	4·6	124

Jones creek.

Location.—At outlet of Jones lake in section 28, township 3, range 27, west of the 6th meridian.

Records Available.—Continuous records since April, 1911, supplied by Messrs. Anderson and Warden, Vancouver. Records in this report continuous since November 1, 1911.

Winter Conditions.—Open water.

Gauge.—Vertical staff, gauge readings made daily by men specially employed by Messrs. Anderson and Warden, Civil Engineers.

Channel.—Uniform section with deep water and a good control.

Discharge Measurements.—One measurement in 1911, one in 1912, and two in 1913 are well distributed and agree fairly well with those taken by Messrs. Anderson and Warden.

Accuracy.—Good measurements and gauge readings.

Jones lake and creek.

Jones creek rises in Jones lake, which is situated in the north-westerly part of township 3, range 27, west of the 6th meridian, and which is at an elevation of 1,950 feet. It is marked Wahleach creek on some of the Dominion sectional Maps. The creek discharges into Fraser river near Ruby creek in section 19, township 4, range 27, at an elevation of about 100 feet. It is part

of the Fraser drainage. Boulder creek enters from the east just below Jones lake. The area of the watershed above the outlet of the lake is 40 square miles. The water is not used at present, but it is proposed to use it for the development of power. Careful hydrographic studies have been made at Jones lake during 1911, 1912, and 1913 by Anderson and Warden, Civil Engineers, Vancouver, acting for the Vancouver Power Company. They established a gauging station on Jones creek at the outlet from Jones lake, and another on Boulder creek near the mouth, and regular gauge readings have been taken since March 24, 1910. The precipitation is from 80 to 90 inches per annum.

Jones lake is situated in a valley high up in a spur of the Cheam mountains, east and north of the town of Chilliwack and about 7 miles east of Agassiz. The waters flow in a northerly direction for about 6 miles, discharging into the Fraser river. The drainage area of 40 square miles lies mostly above the 3,000-foot level, and some of the surrounding mountains are 8,000 feet high. The land near the lake is covered with an inferior growth of timber, mostly spruce and cedar. The ravines and gullies have a thick growth of fern and devil club.

The area of Jones lake is 1,263 acres. The shores of the lake in places rise abruptly from the water, but in other places, especially where small creeks enter, there are to be found low flats and swamps. At the 50-foot contour the area of the lake or reservoir would be about 2,300 acres.

The construction of a 6-mile pipe-line down the Jones creek valley to the Fraser would be very expensive, and the maintenance of such a construction would be difficult. The development proposed by the Vancouver Power Company is by means of a tunnel from the lake at its most westerly point, extending through the mountains to the Fraser valley. This tunnel would be 10,200 feet long, and from its outlet to the power-house the water would be conveyed in pressure pipes 6,000 feet long. In this way an effective head of 1,800 feet would be obtained.

Discharge Measurements of Jones Creek and Jones lake, 1911, 12, 13.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1911.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Nov. 3......	K. H. Smith................	1,057	51	96	0·5	0·55	518
1912.							
Sept. 18......	C. G. Cline..................	1,046	51	104	0·8	0·9	87
1913.							
July 24......	K. G. Chisholm............	1,055	51	180	2·3	2·11	411
Sept. 11......	K. G. C. & F. MacL.........	1,055	51	131	1·3	1·29	175

MONTHLY DISCHARGE of Jones creek and Jones lake for 1911.

(Drainage area, 40 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
November	395	50	140	3·50	3·90	8,330
December	180	68	110	2·75	3·17	6,760

MONTHLY DISCHARGE of Jones Creek at Jones lake for 1912.

(Drainage area, 40 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
January	205	55	84·9	2·12	2·44	5,220
February	190	80	139·4	3·48	3·62	7,720
March	74	49	56·1	1·40	1·61	3,450
April	70	55	62·7	1·57	1·75	3,730
May	320	70	195·7	4·87	5·64	12,000
June	380	170	277·0	6·92	7·72	16,500
July	245	155	211·0	5·28	6·09	13,000
August	320	120	178·7	4·46	5·14	10,900
September	130	60	90·6	2·27	2·53	5,390
October	120	55	79·6	1·99	2·29	4,900
November	320	70	155·6	3·89	4·34	9,230
December	180	70	95·6	2·39	2·75	5,880
The year	380	55	135·3	3·38	45·92	97,920

MONTHLY DISCHARGE of Jones Creek at Jones lake for 1913.

(Drainage area, 40 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
January	80	52	59·4	1·49	1·72	3,650
February	260	49	89·5	2·24	2·33	4,970
March	80	55	66·9	1·67	1·92	4,110
April	180	52	94·8	2·37	2·64	5,640
May	395	89	242·0	6·05	6·98	14,880
June	520	320	397·8	9·94	11·08	23,680
July	425	275	350·0	8·75	10·09	21,520
August	290	145	203·9	5·10	5·88	12,500
September	485	98	179·4	4·48	5·00	10,650
October	610	74	199·0	4·98	5·74	12,200
November	320	98	170·6	4·26	4·75	10,100
December	180	55	84·6	2·11	2·43	5,200
The year	610	49	178·2	4·45	60·57	129,100

NOTE.—Accuracy "A".

DAILY GAUGE HEIGHTS AND DISCHARGES of Jones Creek at Jones lake for 1911.

Day.	November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	......	50	1·15	142
2	......	50	1·10	130
3	0·55	52	1·05	119
4	0·60	55	1·05	119
5	0·65	59	1·00	108
6	0·65	59	1·00	108
7	0·75	68	1·00	108
8	0·95	98	1·15	142
9	0·90	89	1·25	167
10	0·80	74	1·30	180
11	0·70	63	1·30	180
12	0·70	63	1·20	155
13	0·75	68	1·10	130
14	0·75	68	1·00	108
15	0·75	68	1·00	108
16	0·75	68	0·95	98
17	1·00	108	0·90	89
18	1·70	290	0·85	82
19	2·05	395	0·85	82
20	1·90	350	0·85	82
21	1·75	308	0·85	82
22	1·55	245	0·90	89
23	1·45	217	1·05	119
24	1·30	180	1·00	108
25	1·35	192	0·95	98
26	1·45	217	0·90	89
27	1·35	192	0·90	89
28	1·30	180	0·85	82
29	1·20	155	0·80	74
30	1·15	142	0·80	74
31	....	....	0·75	68

Daily Gauge Heights and Discharges of Jones Creek at Jones Lake for 1912.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	0·70	63	1·25	170	0·80	74	0·60	55	0·80	74	1·35	190
2	0·70	63	1·20	155	0·75	70	0·60	55	0·80	74	1·30	180
3	0·65	60	1·10	130	0·75	70	0·65	60	0·80	74	1·25	170
4	0·65	60	1·05	120	0·70	63	0·65	60	0·80	74	1·25	170
5	0·65	60	1·05	120	0·70	63	0·65	60	0·80	74	1·25	170
6	0·65	60	1·05	120	0·65	60	0·65	60	0·75	70	1·30	180
7	0·60	55	1·05	120	0·65	60	0·65	60	0·85	80	1·45	215
8	0·60	55	1·10	130	0·65	60	0·65	60	1·00	108	1·65	275
9	0·60	55	1·15	140	0·65	60	0·65	60	1·20	155	1·65	275
10	0·60	55	1·30	180	0·60	55	0·70	63	1·20	155	1·65	275
11	0·60	55	1·25	170	0·60	55	0·75	70	1·20	155	1·60	260
12	0·60	55	1·20	155	0·60	55	0·75	70	1·25	170	1·65	275
13	0·70	63	1·15	140	0·55	52	0·75	70	1·40	205	1·80	320
14	0·80	74	1·25	170	0·55	52	0·70	63	1·60	260	1·90	350
15	0·90	89	1·20	155	0·55	52	0·70	63	1·80	320	1·85	335
16	1·00	108	1·25	170	0·55	52	0·70	63	1·70	290	1·70	290
17	0·95	98	1·30	180	0·55	52	0·70	63	1·55	245	1·60	260
18	0·90	84	1·35	190	0·55	52	0·70	63	1·45	215	1·65	275
19	0·85	80	1·30	180	0·55	52	0·70	63	1·40	205	1·75	305
20	0·75	70	1·20	155	0·55	52	0·70	63	1·50	230	1·85	335
21	0·80	74	1·10	130	0·55	52	0·70	63	1·70	290	2·00	380
22	0·80	74	11·10	130	0·50	49	0·70	63	1·70	290	1·90	350
23	0·80	74	1·05	120	0·50	49	0·70	63	1·60	260	1·80	320
24	0·80	74	1·00	108	0·50	49	0·70	63	1·50	230	1·80	320
25	1·00	108	0·95	98	0·50	49	0·70	63	1·50	230	1·85	335
26	1·05	120	0·95	88	0·55	52	0·70	63	1·60	260	1·90	350
27	1·05	120	0·90	89	0·55	52	0·70	63	1·70	290	1·90	350
28	1·00	108	0·85	80	0·55	52	0·70	63	1·65	275	1·80	320
29	1·05	120	....	....	0·60	55	0·70	63	1·60	260	1·60	260
30	1·40	205	....	....	0·65	60	0·75	70	1·50	230	1·45	220
31	1·35	190	....	....	0·65	60	....	....	1·40	205	....	....

Daily Gauge Heights and Discharges of Jones Creek at Jones Lake for 1912—*Concluded.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feef.	Sec.-ft.	Feet.	Sec.-ft.
1	1·35	195	1·25	170	1·10	130	0·70	63	0·80	74	1·05	120
2	1·45	220	1·25	170	1·10	130	0·70	63	0·75	70	1·05	120
3	1·40	205	1·20	155	1·10	130	0·80	74	0·75	70	1·30	180
4	1·40	205	1·15	145	1·05	120	0·80	74	0·75	70	1·30	180
5	1·40	205	1·15	145	1·00	108	0·80	74	0·75	70	1·20	155
6	1·50	230	1·10	130	0·95	99	0·75	70	0·75	70	1·10	130
7	1·50	230	1·05	120	1·00	108	0·75	70	0·80	74	1·00	108
8	1·45	220	1·10	130	1·05	120	0·80	74	0·80	74	0·95	98
9	1·40	205	1·25	170	1·05	120	0·80	74	0·80	74	0·95	98
10	1·35	195	1·55	245	1·00	108	0·75	70	0·80	74	0·90	89
11	1·35	195	1·80	320	1·00	108	9·70	63	0·80	74	0·85	80
12	1·35	195	1·60	260	1·00	108	0·70	63	0·85	80	0·90	89
13	1·55	245	1·45	220	1·00	108	0·65	60	0·40	205	0·85	80
14	1·55	245	1·35	195	1·00	108	0·65	60	1·40	205	0·90	89
15	1·55	245	1·40	205	0·95	99	0·60	55	1·30	180	0·90	89
16	1·50	230	1·55	245	0·99	89	0·70	63	1·15	145	0·85	80
17	1·50	230	1·50	230	0·90	89	1·05	120	1·10	130	0·95	98
18	1·50	230	1·45	220	0·90	89	1·00	108	1·40	205	0·95	98
19	1·50	230	1·40	205	0·85	80	1·00	108	1·80	320	0·95	98
20	1·50	230	1·35	195	0·80	74	0·95	98	1·75	305	0·85	80
21	1·45	220	1·30	180	0·80	74	0·90	89	1·75	305	0·80	74
22	1·45	220	1·30	180	0·80	74	0·85	80	1·65	275	0·80	74
23	1·40	205	1·30	180	0·80	74	0·85	80	1·65	275	0·80	74
24	1·40	205	1·30	180	0·80	74	0·85	80	1·55	245	0·80	74
25	1·40	205	1·30	180	0·75	70	0·95	98	1·45	220	0·80	74
26	1·45	220	1·25	170	0·75	70	1·00	108	1·35	195	0·75	70
27	1·40	205	1·20	155	0·70	63	0·95	98	1·25	170	0·75	70
28	1·30	180	1·10	130	0·70	63	0·90	89	1·20	155	0·75	70
29	1·25	170	1·05	120	0·65	60	0·90	89	1·10	130	0·75	70
30	1·20	155	1·05	120	0·65	60	0·85	80	1·10	130	0·80	74
31	1·20	155	1·05	120	....	....	0·80	74	....	....	0·85	80

DAILY GAUGE HEIGHTS AND DISCHARGES of Jones Creek at Jones Lake for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge	Gauge Height.	Discharge.	Gauge Height.	Discharge	Gauge Height.	Discharge	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	0·85	80	0·60	55	0·75	70	0·60	55	1·00	108	2·05	395
2	0·80	74	0·60	55	0·75	70	0·60	55	0·95	98	2·30	470
3	0·75	70	0·55	53	0·75	70	0·60	55	0·95	98	2·45	520
4	0·75	70	0·55	53	0·75	70	0·55	52	0·90	89	2·45	520
5	0·75	70	0·50	49	0·75	70	0·55	52	0·90	89	2·30	470
6	0·75	70	0·50	49	0·75	70	0·55	52	0·90	89	2·10	410
7	0·75	70	0·50	49	0·75	70	0·55	52	0·95	98	2·10	410
8	0·75	70	0·50	49	0·75	70	0·55	52	1·10	130	2·20	440
9	0·70	63	0·50	49	0·75	70	0·55	52	1·35	192	2·10	410
10	0·65	60	0·50	49	0·75	70	0·55	52	1·50	230	2·00	380
11	0·65	60	0·50	49	0·70	63	0·55	52	1·60	260	1·95	365
12	0·60	55	0·50	49	0·80	74	0·65	59	1·60	260	1·90	350
13	0·60	55	0·50	49	0·75	70	0·80	74	1·65	275	2·10	410
14	0·60	55	0·50	49	0·70	63	0·90	89	1·65	275	2·15	425
15	0·55	52	0·70	63	0·70	63	0·90	89	1·65	275	2·05	395
16	0·55	52	1·15	142	0·70	63	0·90	89	1·65	275	2·00	380
17	0·55	52	1·60	260	0·85	80	0·90	89	1·60	260	1·85	335
18	0·55	52	1·50	230	0·85	80	0·95	98	1·50	230	1·80	320
19	0·55	52	1·35	192	0·85	80	1·05	119	1·50	230	1·85	335
20	0·55	52	1·20	155	0·80	74	1·15	142	1·50	230	2·30	470
21	0·55	52	1·10	130	0·75	70	1·30	180	1·50	230	2·20	440
22	0·55	52	1·00	108	0·75	70	1·30	180	1·55	245	2·10	410
23	0·55	52	1·00	108	0·70	63	1·20	155	1·75	305	2·00	380
24	0·55	52	0·95	98	0·65	60	1·15	142	1·90	350	1·95	365
25	0·60	55	0·90	89	0·65	60	1·10	130	1·95	365	1·95	365
26	0·70	63	0·85	81	0·60	55	1·05	119	2·05	395	1·90	350
27	0·65	60	0·80	74	0·60	55	1·10	130	2·05	395	1·90	350
28	0·65	60	0·75	70	0·60	55	1·10	130	2·05	395	1·90	350
29	0·60	55	....	....	0·60	55	1·10	130	1·90	350	1·90	350
30	0·60	55	....	....	0·65	60	1·05	119	1·85	335	1·95	364
31	0·60	55	....	....	0·65	60	....	....	1·90	350	....	....

Daily Gauge Heights and Discharges of Jones Creek at Jones Lake for 1913—*Concluded.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	2·00	380	1·70	290	1·15	145	0·95	98	1·05	120	1·30	180
2	1·95	365	1·70	290	1·10	130	0·90	89	1·05	120	1·20	155
3	1·85	335	1·70	290	1·10	130	0·90	89	0·95	98	1·10	130
4	1·75	305	1·65	275	2·05	395	0·85	80	1·05	120	1·05	120
5	1·85	335	1·65	275	2·35	485	0·80	74	1·05	120	1·00	108
6	1·90	350	1·60	260	2·20	440	0·80	74	1·15	140	1·00	108
7	2·10	410	1·55	245	1·80	320	0·80	74	1·10	130	1·00	108
8	2·00	380	1·60	260	1·60	260	0·80	74	1·05	120	1·00	108
9	1·90	350	1·55	245	1·50	230	0·85	80	1·10	130	0·95	98
10	2·05	395	1·50	230	1·40	205	0·90	89	1·20	155	0·90	89
11	2·10	410	1·45	215	1·30	180	2·10	410	1·15	140	0·90	89
12	2·05	395	1·45	215	1·25	170	2·70	610	1·05	120	0·90	89
13	2·10	410	1·40	205	1·20	155	2·70	610	1·00	108	0·85	80
14	2·00	200	1·35	195	1·15	145	2·25	455	0·95	98	0·80	74
15	1·80	320	1·35	195	1·10	130	1·95	365	0·95	98	0·85	80
16	1·70	290	1·30	180	1·05	120	1·70	290	1·80	320	0·80	74
17	1·65	275	1·30	180	1·05	120	1·50	230	1·80	320	0·80	74
18	1·65	275	1·35	195	1·15	145	1·45	220	1·65	275	0·80	74
19	1·70	290	1·30	180	1·15	145	1·35	190	1·50	230	0·75	70
20	1·95	365	1·20	155	1·10	130	1·30	180	1·35	190	0·75	70
21	2·10	410	1·15	145	1·05	120	1·25	165	1·25	165	0·75	70
22	2·15	425	1·15	145	1·20	155	1·20	155	1·15	140	0·70	63
23	2·15	425	1·25	170	1·15	145	1·25	165	1·10	130	0·65	60
24	2·10	410	1·25	170	1·05	120	1·45	215	1·50	230	0·65	60
25	2·05	395	1·25	170	1·00	108	1·45	215	1·65	275	0·65	60
26	1·90	350	1·25	170	1·00	108	1·35	190	1·50	230	0·60	55
27	1·85	335	1·20	155	0·95	98	1·30	180	1·45	220	0·60	55
28	1·80	320	1·20	155	1·05	120	1·20	155	1·40	205	0·60	55
29	1·95	365	1·20	155	1·05	120	1·15	140	1·35	190	0·60	55
30	1·75	305	1·20	155	1·00	108	1·05	120	1·30	180	0·60	55
31	1·65	275	1·20	155	....	....	1·05	120	....	....	0·60	55

MESLILOET RIVER.

Location.—Near mouth of Canyon, 8 miles from mouth of river, in section 8, township 7, range 7, west of 7th meridian.

Records Available.—Continuous since October 31, 1912.

Winter Conditions.—Open water all year.

Gauge.—Vertical staff gauge, four or five readings a week.

Channel.—Bed of stream rocky, water swift at higher stages.

Discharge Measurements.—One measurement in 1912 and nine in 1913 are well distributed and do not show any great discrepancy.

Accuracy.—Meter measurements good and gauge readings nearly every day should give good results.

MESLILOET (INDIAN) RIVER.

Mesliloet or Indian river has its source in the mountains east of Howe sound at an elevation of some 3,000 feet, and discharges into the North Arm of Burrard inlet at sea-level. The drainage area above the mouth is estimated at 75 square miles. About 7 miles from the mouth of the river there is a canyon which provides a good site for power development. A gauging station has been established at this point, and the drainage area lying above it is estimated at 65 square miles.

The watershed of the Mesliloet river is quite mountainous and lies close to the coast. On this account it receives quite a heavy precipitation, amounting to between 120 and 150 inches. There is a heavy snowfall in the winter, particularly in the higher altitudes. Winter thaws and rains are frequent, and these often cause winter freshets.

The more important tributaries are: Hixon creek, Brandt creek, and the Left Fork. These streams all enter from the east. There are no tributaries of any importance entering from the west.

There is considerable good timber in the watershed, consisting mostly of fir and cedar. A certain amount of the cedar has been cut into shingle bolts, but very little fir has been removed as yet. The stream has been used for running shingle bolts, but is not suitable for running logs. It will be necessary to build a railroad to get the logs out. Messrs. Brittenham & Young, of Maddison, Wis., who own much of the timber in the valley, are said to be planning to build a saw-mill on Burrard inlet, at the mouth of the Mesliloet river. Booming grounds have already been laid out, but nothing further has been done as yet.

The Indian River Park Company has built a summer hotel, Wigwam Inn, and laid out a small park near the mouth of the river. The place is getting to be quite a pleasure resort, and the company's steamer makes regular trips to Vancouver during the summer.

There are good gravel deposits at the mouth of the Mesliloet river. A couple of dredges are usually working there supplying gravel for use in the city of Vancouver.

Salmon run up the river for several miles, and a good catch is made every year by the Indians who have a small reserve near the mouth.

There is very little agricultural land in the Mesliloet valley, and what little there is, is mostly covered with heavy timber at present. There is no agricultural development in the valley except a small garden near the Indian reserve.

At the canyon there is a good site for power development. A dam could be raised at this point to a height of 50 feet or more, and it would give splendid storage in the valley above. A 2½-mile pipe line could develop a head of about 350 feet. On the two tributaries, Brandt and Hixon, a high-head development of some 2,000 feet is possible. These streams and their tributaries, Young and Belknap, have good storage facilities, though their combined flow is not nearly as great as that of the Mesliloet proper. The Westminster Power Company, which has applied for the water rights on the main river and also on the tributaries, proposes to place the machinery for its two developments in the one power-house, to be situated near the mouth of Brandt creek.

The Mesliloet river can be reached by boat from Vancouver. There is a landing place at the Wigwam Inn. From the landing there is a trail going up towards the wagon road, but there is no bridge across the river. The best way of getting to the wagon road is by using a canoe or small boat from the hotel. The road runs up the valley some 6 miles to an abandoned logging camp. Horses using this trail must ford the river at three places. There is a suspension foot bridge at the lower ford and a foot trail connecting the two upper fords, so that it is not necessary to cross the river at these points when travelling on foot. From the camp there is a foot trail up the main valley, and this has recently been run through to Squamish for the convenience of fire rangers. There is also a regular pack trail from the camp to Norton lake. This trail has been laid out and cleared so that pack horses can travel it. A cabin at Norton lake provides headquarters for the gauge readers to the upper stations. From this cabin there are trails leading to upper Brandt creek, Young creek, Ann lake, Belknap lake, and upper Hixon creek. At present there are no horses in the valley. All travelling must be done on foot, and the gauge readers pack in their own supplies. Sometimes supplies can be conveyed up the river to the lumber camp by canoe.

A gauging station was maintained for a year at the mouth of the Mesliloet river, but in October, 1912, a new station was established close to the canyon to take its place. Regular readings are being taken at this latter station which gives the exact amount of water available at the proposed intake site. There are also a number of gauging stations on the tributary streams, to give the necessary data in connection with the high-head development. They are as follows: Brandt creek and tributaries—Brandt at mouth, Brandt above Young creek, Young creek at mouth, Norton creek at Norton lake; Hixon creek and tributaries—Hixon creek at mouth, Hixon creek above Belknap creek, Belknap creek at Belknap lake, Belknap creek below Ann lake.

Discharge Measurements of Mesliloet River at Upper Station, 1912, and 1913

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
1912.							
Oct. 31......	C. G. Cline....................	1,046	70	120·0	1·57	2·26	188
1913.							
June 6......	H. C. Hughes................	1,673	80	232·0	2·90	3·25	662
" 13......	do	1,673	80	239·5	3·12	3·40	713
" 17......	do	1,673	80	195·0	2·40	2·90	446
July 3......	do	1,673	80	203·4	2·40	2·98	471
" 29......	do	1,673	75	146·0	1·65	2·28	230
Sept. 17......	C. G. Cline....................	1,673	70	109·0	1·16	1·87	122
Oct. 9......	F. MacLachlan................	1,673	77	81·0	0·94	1·61	76·5
Nov. 10......	do	1,521	83	186·0	2·20	2·86	417
" 16......	do	1,521	85	277·0	3·47	3·58	942

Monthly Discharge of Mesliloet River at Canyon—8 miles from Mouth for 1913

(Drainage area, 65 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
January..................................	147	60	78	1·2	1·38	4,800
February.................................	1,720	50	283	4·4	4·58	15,700
March....................................	222	72	131	2·0	2·31	8,055
April.....................................	690	89	337	5·2	5·80	20,000
May.......................................	1,370	180	645	10·0	11·53	39,700
June......................................	1,290	436	716	11·0	12·27	42,600
July.......................................	1,110	185	449	7·0	8·07	27,600
August....................................	368	106	188	3·0	3·46	11,560
September...............................	485	89	214	3·3	3·68	12,700
October..................................	2,120	72	293	4·5	5·18	18,000
November................................	1,880	98	594	9·1	10·15	35,300
December................................	755	115	269	4·1	4·72	16,540
The year..................................	2,120	50	350	5·4	73·10	252,600

Note.—Accuracy "A" and "C".

Monthly Discharge of Mesliloet River at Canyon, 8 miles from Mouth, for 1912.

(Drainage area 65 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet
November	1,720	160	599	9·2	10·3	34,500
December	1,510	136	246	3·8	4·4	14,600

Note.—Accuracy "A" and "C".

Daily Gauge Heights and Discharges of Mesliloet River near Canyon for 1912.

Day.	October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1			2·15	182	2·05	160
2				225		195
3				268	2·35	237
4			2·6	311		223
5			3·15	570	2·05	160
6				545		177
7				520	2·0	147
8				495	1·95	136
9				470		160
10				445		196
11			2·85	420	2·3	222
12				1,070	2·3	222
13			4·8	1,720	4·5	1,510
14			3·25	620	2·8	389
15				585	2·4	251
16				550		251
17			3·05	515	2·4	251
18			4·8	1,720	2·75	368
19			4·55	1,545	2·3	222
20			3·5	790	2·2	195
21			3·9	1,080		188
22				810	2·15	182
23			3·1	540		164
24			3·15	570	2·0	147
25			2·7	347		141
26			2·45	266	1·95	136
27			2·35	237	2·3	222
28			2·2	195	2·1	170
29				201		182
30			2·05	160	2·2	195
31	2·25	208			2·3	222

Daily Gauge Heights and Discharges of Mesliloet River, near Upper Station for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	2·0	147	....	69	1·6	72	1·7	89	....	210	....	1,130
2	1·95	136	1·55	66	....	72	....	100	2·2	195	4·2	1,290
3	1·9	125	....	66	1·6	72	1·8	106	....	190	....	1,080
4	....	107	1·55	66	....	84	2·0	147	....	185	....	870
5	1·7	89	....	63	1·75	97	2·2	195	2·15	180	3·3	660
6	1·7	89	1·5	60	1·85	115	....	170	....	300	3·25	630
7	....	86	....	58	....	155	2·0	147	2·85	415	3·4	720
8	....	83	1·45	55	....	188	2·0	147	3·2	595	....	670
9	1·65	80	....	55	2·3	222	2·2	195	....	840	3·25	620
10	....	75	1·45	55	2·1	170	2·45	265	3·9	1,080	....	640
11	....	70	....	52	....	180	....	415	....	950	....	660
12	1·55	66	1·4	50	2·1	170	3·15	565	3·55	825	3·35	690
13	....	66	....	470	....	160	2·8	389	3·2	595	3·4	720
14	1·55	66	....	890	....	148	....	363	....	660	3·4	720
15	....	64	....	1,300	1·95	136	....	337	3·4	720	....	680
16	....	62	4·8	1,720	....	165	2·6	311	....	580	3·25	620
17	1·5	60	....	1,050	....	195	2·65	330	2·9	436	2·9	436
18	....	60	2·8	389	2·3	222	2·85	415	....	470	2·85	415
19	1·5	60	2·4	251	2·3	222	3·3	660	....	500	....	600
20	....	60	....	200	....	168	....	675	3·1	540	3·5	790
21	1·5	60	2·05	160	1·85	115	3·35	690	....	600	4·0	1,150
22	1·5	60	....	145	....	105	....	540	....	660	3·45	755
23	....	65	....	135	....	90	2·8	389	3·4	720	....	730
24	....	70	....	120	1·65	80	2·45	265	3·3	660	....	710
25	....	75	1·8	106	....	75	....	375	....	940	....	690
26	1·65	80	....	95	....	75	3·0	485	4·1	1,220	3·3	660
27	....	76	1·7	89	1·6	72	....	437	4·3	1,370	3·2	595
28	1·6	72	1·65	80	....	100	2·8	389	....	1,000	....	560
29	....	72	....	....	1·9	125	....	305	3·3	660	3·05	520
30	....	72	....	....	....	115	2·3	222	....	720	....	510
31	1·6	72	....	....	1·8	106	....	....	....	970	....	....

DAILY GAUGE HEIGHTS AND DISCHARGES of Mesliloet River near Upper Station for 1913—*Concluded.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	500	2·3	222	....	230	....	140	....	100	2·7	347
2	....	595	2·3	222	....	260	....	120	1·85	115	....	290
3	3·0	485	....	222	....	290	1·75	98	1·75	98	2·35	235
4	3·0	485	2·3	222	....	320	....	85	....	214	....	235
5	3·05	520	....	204	....	370	1·6	72	2·65	330	2·35	235
6	3·95	1,110	2·15	185	....	410	....	72	2·55	295	....	250
7	3·4	720	2·1	170	....	450	....	72	....	640	2·45	265
8	3·1	540	2·1	170	3·0	485	....	72	....	980	2·25	210
9	2·15	185	....	165	2·8	389	1·6	72	4·25	1,330	....	190
10	....	310	....	165	2·65	329	....	400	2·9	436	2·1	170
11	2·9	436	2·05	160	....	260	3·4	720	....	310	....	280
12	....	390	2·1	170	2·2	195	5·3	2,120	2·15	185	2·8	389
13	....	340	....	190	2·1	170	4·2	1,290	....	150	....	570
14	2·55	295	2·25	210	....	150	....	820	1·85	115	3·45	755
15	2·55	295	....	250	1·9	125	2·7	347	....	550	3·05	520
16	....	385	....	290	1·9	125	2·55	295	3·78	990	2·8	389
17	....	475	....	330	1·85	115	....	270	....	600	....	327
18	3·15	565	2·75	368	1·85	115	....	240	2·25	210	2·45	265
19	3·3	660	....	258	1·8	106	....	210	2·25	210	....	230
20	....	615	2·0	147	1·8	106	2·15	185	....	180	....	190
21	....	570	2·0	147	....	115	....	160	2·0	147	2·0	147
22	....	525	2·0	147	1·9	125	1·95	136	2·0	147	....	147
23	....	480	2·0	147	1·8	106	....	160	....	1,010	2·0	147
24	2·9	436	....	136	....	95	2·15	185	5·0	1,880	....	130
25	2·8	389	1·9	125	1·7	89	....	150	4·7	1,650	1·85	115
26	....	355	1·9	125	1·7	89	1·85	115	4·3	1,370	....	184
27	2·65	320	....	119	1·8	106	1·8	106	3·9	1,080	2·4	251
28	2·5	280	....	113	2·65	330	....	100	....	1,050	2·1	170
29	2·3	222	1·8	106	2·2	195	1·75	98	3·8	1,010	....	200
30	....	222	....	145	2·05	160	1·65	80	2·9	436	....	240
31	2·3	222	....	185	....	....	....	90	....	....	2·5	280

NORTH LILLOOET RIVER.

Location.—Five miles from mouth of stream, in section 29, township 12, east of Coast meridian.

Records Available.—Continuous records from October 27, 1911, to December 11, 1913.

Winter Conditions.—Open water all year.

Gauge.—Vertical staff gauge on bridge pile. Daily gauge readings.

Channel.—Gravel bottom, water deep and quiet at gauge.

Discharge Measurements.—Two measurements in 1911, five in 1912, and one in 1913 show fair agreement and are well distributed except for the highest stages.

Accuracy.—Records should be quite accurate.

NORTH LILLOOET RIVER.

The North Lillooet river has its source in the Golden Ears mountain (5560 feet) at an elevation of 4,000 feet. It joins the South Lillooet river 2 miles from Pitt river about 20 feet above sea-level. The drainage area is about 20 sq. miles, and precipitation varies from 70 inches at the mouth to 80 inches or more at the headwaters. The stream is open all the year round, and the winter conditions are not severe. About 5 miles above the mouth the North Lillooet

is within a few hundred feet of the South Lillooet. West of that point both streams flow through rich bottom lands, are deep and sluggish, and at high water often overflow the surrounding lands. Some of these are being dyked and farmed, and are very valuable. The upper part of the watershed is mountainous. A prominent peak, mount Blanchard, known locally as the Golden Ears, rises to an elevation of 5500 feet. This peak is snowcapped practically all the year round. In the upper part of the stream the bed has a very rapid fall, and during high water many trees are washed out and carried down into the flats, where they give much trouble by obstructing the channel and causing the river to overflow and sometimes even to change its course.

Near the northern boundary of township 12, E. C. M., there is a series of falls on the stream with a total drop of some 60 feet in about 200 yards. A company has a water record to use water for power purposes at this point, in connection with a proposed rock quarry. The municipality of Maple Ridge plans to draw its water supply from the stream above the falls.

The station was established by C. G. Cline on October 27 1911, and gauge readings were taken continuously till December, 1913. It was located at the bridge on the North Lillooet river at Sibley's blacksmith shop, just below a high-water slough from the South Lillooet river, and directly north of Port Haney. The gauge is a standard vertical staff gauge 7½ feet long, and is nailed to the south side of the planking on the piling of the bridge near the right bank. It is referred to three permanent bench-marks.

DISCHARGE MEASUREMENTS of North Lillooet River, 5 Miles from Mouth, 1911 and 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
1911.							
Oct. 27......	Cline and Smith............	1,057	47	16·3	1·79	4·35	291
Dec. 19......	H. M. Smith................	1,057	16	13·0	0·87	2·28	11·3
1912.							
Mar. 16......	C. G. Cline................	1,046	19	24·6	0·7	2·60	17·3
July 4......	do	1,046	32	24·7	0·92	2·7	22·8
Aug. 17......	do	1,046	39	44·7	2·16	3·65	96·2
Sept. 10......	do	1,046	32	27·0	1·30	2·89	35·1
Nov. 14......	do	1,046	42	115·0	1·48	3·91	170
1913.							
July 11......	K. G. Chisholm............	1,055	34	44·3	2·32	3·48	102

Monthly Discharge of North Lillooet River, 5 miles from Mouth, for 1913.

(Drainage area, 20 square miles.)

Month.	Discharge in Second-feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
January	865	29	77·1	3·85	4·44	4,740
February	1,535	20	174·1	8·70	9·38	9,660
March	1,197	20	118·6	5·93	6·84	7,320
April	470	42	138·1	6·91	7·71	8,210
May	590	35	151·2	7·56	8·72	9,280
June	287	50	83·7	4·18	4·66	4,980
July	243	20	61·2	3·06	3·53	3,760
August	188	14	28·4	1·42	1·64	1,750
September	400	8	39·3	1·96	2·19	2,340
October	1,220	9	151·8	7·59	8·75	9,350
November	1,580	14	228·3	11·40	12·72	13,600
December	400	42	77·9	3·90	4·50	4,790
The year	1,580	8	111·0	5·54	75·10	79,800

Daily Gauge Heights and Discharges of North Lilloet River 5 miles from Mouth, for 1913

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft
1	3·7	123	3·0	42	2·6	20	3·1	50	3·0	42	4·0	188
2	3·4	81	3·0	42	2·7	24	3·0	42	2·9	35	3·7	123
3	3·4	81	3·0	42	2·7	24	3·0	42	2·9	35	3·5	93
4	3·2	59	2·9	35	2·7	24	3·0	42	3·0	42	3·5	93
5	3·4	81	2·9	35	2·8	29	4·0	188	3·0	42	3·2	59
6	3·0	42	2·8	29	3·2	59	3·9	163	3·5	93	3·1	50
7	3·0	42	2·8	29	3·4	81	3·5	93	3·4	81	3·4	81
8	2·9	35	2·8	29	3·5	93	3·2	59	3·7	123	3·4	81
9	2·9	35	2·8	29	3·4	81	3·2	59	4·2	243	3·2	59
10	2·8	29	2·8	29	3·3	69	3·4	81	4·0	188	3·1	50
11	2·8	29	2·8	29	3·2	59	4·0	188	5·2	590	3·1	50
12	2·8	29	2·7	24	3·1	50	4·2	243	4·7	400	3·4	81
13	2·8	29	2·6	20	3·0	42	3·8	141	4·2	243	3·2	59
14	3·8	29	3·25	64	3·0	42	3·6	107	4·6	365	3·2	59
15	2·8	29	7·2	1,445	2·9	35	3·5	93	4·45	319	3·4	81
16	2·8	29	7·4	1,535	3·4	81	3·3	69	4·0	243	3·6	107
17	2·8	29	5·65	770	6·65	1,197	3·3	69	3·6	107	3·2	59
18	2·8	29	4·2	243	5·3	630	3·7	123	3·5	93	3·1	50
19	3·8	29	3·6	107	3·8	141	3·2	243	3·5	93	3·3	69
20	2·7	24	3·2	59	3·6	107	4·9	470	3·3	69	3·9	163
21	2·7	24	3·1	50	2·9	35	4·5	335	3·3	69	3·4	81
22	2·7	24	2·9	35	2·9	35	4·7	400	3·5	93	3·4	81
23	3·0	42	2·9	35	2·8	29	3·3	69	3·5	93	3·2	59
24	3·0	42	2·8	29	2·75	27	3·5	93	3·7	123	3·1	50
25	5·0	865	2·7	24	2·7	24	3·6	107	3·6	107	3·2	59
26	4·0	188	2·7	24	2·65	22	4·4	303	3·9	163	3·1	50
27	3·5	93	2·6	20	2·7	24	3·4	81	4·2	243	3·1	50
28	3·3	69	2·6	20	2·9	35	3·4	81	3·6	107	3·1	50
29	3·2	59	....	....	4·5	335	3·2	59	3·3	69	3·3	69
30	3·1	50	....	....	3·8	141	3·1	50	3·3	69	4·35	287
31	3·0	42	....	....	3·4	81	....	....	3·6	107	....	....

Daily Gauge Heights and Discharges of North Lillooet River, 5 miles from Mouth, for 1913.

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	4·1	215	2·6	20	2·4	14	2·4	14	2·5	17	4·7	400
2	3·8	141	2·6	20	2·4	14	2·3	11	2·5	17	4·5	335
3	3·5	93	2·6	20	3·9	163	2·2	9	2·4	14	4·3	272
4	3·3	69	2·6	20	4·7	400	2·2	9	2·4	14	3·2	59
5	3·2	59	2·5	17	3·8	141	2·2	9	4·2	243	3·1	50
6	3·2	59	2·5	17	3·2	59	2·2	9	5·6	750	3·0	42
7	3·2	59	2·5	17	2·9	35	2·4	14	3·5	93	3·5	93
8	3·1	50	2·4	14	2·7	24	2·4	14	3·4	81	3·1	50
9	3·1	50	2·4	14	2·8	29	2·6	20	3·85	152	3·0	42
10	4·2	243	2·5	17	2·7	24	3·0	42	3·4	81	2·8	29
11	3·5	993	2·5	17	2·5	17	6·6	1,175	3·1	50	3·0	42
12	3·2	59	2·6	20	2·5	17	6·7	1,220	2·8	29	....	50
13	3·2	559	2·6	20	2·4	14	6·7	1,220	2·7	24	....	50
14	3·2	59	2·6	20	2·3	11	4·5	335	2·6	200	....	50
15	3·0	42	2·9	35	2·3	11	3·8	141	2·7	24	....	50
16	2·9	35	2·6	20	2·3	11	3·4	81	6·75	1,242	....	50
17	3·05	46	2·7	24	2·3	11	3·0	42	4·4	303	....	50
18	3·0	42	4·0	188	2·3	11	2·9	35	3·4	81	....	50
19	3·0	42	3·7	123	2·3	11	2·9	35	3·3	69	....	50
20	3·0	42	8·9	35	2·2	9	2·8	299	3·5	93	....	50
21	3·1	50	2·8	29	2·2	9	2·6	20	3·0	69	[1]	50
22	3·0	42	2·7	24	2·5	17	2·6	20	3·1	50	....	50
23	2·95	39	2·7	24	2·3	11	2·8	29	3·4	81	....	50
24	2·9	35	2·6	20	2·2	9	2·8	29	7·5	1,580	....	50
25	2·8	29	2·5	17	2·2	9	2·8	29	5·0	510	....	50
26	2·8	29	2·5	17	2·2	9	2·7	24	4·6	365	....	50
27	2·7	24	2·5	17	2·15	8	2·6	20	3·2	59	....	50
28	2·7	24	2·4	14	3·1	50	2·5	17	4·0	188	....	50
29	2·7	24	2·4	14	2·5	17	2·5	17	4·5	335	....	50
30	2·7	24	2·4	14	2·4	14	2·5	17	4·1	215	....	50
31	2·6	20	2·4	14	....	....	2·6	20	....	....	....	50

[1] Estimated.

NORTON CREEK.

Location.—At Norton lake, in section 10, township 7, range 7, west of 7th meridian.

Records Available.—Continuous records since October 20, 1912.

Winter Conditions.—Very heavy snowfall, and lake freezes over, but very little ice in stream at gauging station.

Gauge.—Vertical staff gauge. Gauge readings irregular, one or two a week.

Channel.—Rocky and permanent.

Discharge Measurements.—One measurement in 1912 and seven in 1913 show good agreement, and cover all except the highest stages.

Accuracy.—The infrequency of the gauge readings will tend to impair the accuracy of the results.

NORTON CREEK.

Norton creek has its source in Norton lake, at an elevation of 2,100 feet, and discharges into Brandt creek about a mile from its mouth, at an elevation of 1,500 feet. It is part of Burrard Inlet drainage.

The rainfall around Norton lake is something over 120 inches. In the winter there is generally a snowfall of 3 or 4 feet or more. The lake freezes over, but the stream generally remains open.

The Westminster Power Company proposes to include Norton lake in its high-head power development. The lake is to be used as the main storage and equalizing reservoir. Water from upper Brandt creek, Norton lake, and Belknap creek is to be diverted into Norton lake. A large dam is to be constructed at the outlet of the lake to provide storage and to regulate the entrance of water into the pipes. The main pipeline is to lead from Norton lake to a small reservoir on the hill above the power-house. From the reservoir, steel penstocks will lead down to the power-house, which is to be situated near the mouth of Brandt creek. A head of some 2,000 feet will be developed by this installation. Storage in Norton, Young, and Ann lakes will give a very uniform flow, and conserve practically all the freshet water for use during the low-water seasons.

A cabin has been constructed at Norton lake, and it is to be made the headquarters for the gauge readers. From this cabin, trails lead to upper Brandt creek, Young lake, Belknap lake, and Hixon creek. A horse trail connects the cabin with the camp in the main Mesliloet valley, and a wagon road leads from there to Burrard Inlet.

A gauging station was established on the 20th of October, 1912, by this survey on Norton creek at Norton lake. This station has been maintained since that date, but the gauge readings have been somewhat irregular as the gauge readers had their headquarters in the lower valley, and the travelling is very difficult in the winter on account of the deep snow and the steep climb. The gauging station gives the flow from Norton lake, and the total amount of the water measured by it could be used in the proposed water-power development. The transfer of the gauge readers' headquarters to Norton lake in 1914 should give more reliable results in the future.

DISCHARGE MEASUREMENTS of Norton Creek at Norton lake, 1912 and 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1912.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Oct. 20	C. G. Cline	1,046	9·0	11·8	0·64	2·53	7·58
1913.							
June 3	H. C. Hughes	1,673	16·0	16·0	1·02	2·85	16·30
" 10	do	1,673	8·5	9·3	1·00	2·60	9·34
" 24	do	1,673	8·0	7·5	0·76	2·52	5·75
July 7	do	1,673	10·0	13·3	0·58	2·53	7·72
" 23	do	1,673	6·0	6·4	0·27	2·11	1·76
Aug. 2	do	1,673	6·0	5·15	0·10	1·85	0·50
Sept. 23	F. MacLachlan	1,673	3·5	1·95	0·93	2·06	[1]1·82

NOTE.—[1]Different section.

MONTHLY DISCHARGE of Norton Creek below Norton lake for 1913.

Month.	Discharge in Second-Feet.			Run-Off.
	Maximum.	Minimum.	Mean.	Total in acre-feet.
January	3·6	1·9	2·5	154
February	11·0	1·2	3·9	217
March	3·7	2·7	2·9	178
April	8·6	2·7	6·4	380
May	36·0	5·2	19·0	1,170
June	16·0	6·0	8·7	518
July	7·3	1·0	3·8	234
August	1·9	0·5	0·86	53
September	30·0	1·2	7·0	416
October	52·5	1·2	9·5	584
November	69·0	3·1	23·8	1,416
December	21·0	6·4	10·0	615
The year	69·0	0·5	8·2	5,935

NOTE.—Accuracy "A" and "C".

MONTHLY DISCHARGE of Norton Creek below Norton lake for 1912.

Month.	Discharge in Second-Feet.			Run-Off.
	Maximum.	Minimum.	Mean.	Total in acre-feet.
November	27·0	9·0	15·5	920
December	11·0	3·7	5·63	346

NOTE.—Accuracy "A".

Daily Gauge Heights and Discharges of Norton Creek at Norton lake for 1912.

Day.	October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1				11·0		8·0
2				11·5		7·5
3				12·0	2·5	6·7
4				12·5		5·5
5				13·0		4·3
6				13·0		3·1
7				13·5	2·1	1·9
8			2·8	14·0		2·5
9			2·7	11·0		3·1
10			2·7	11·0	2·3	3·7
11				12·0		5·5
12				13·0		7·3
13				14·0		9·1
14				15·0	2·7	11·0
15				17·0		10·1
16				18·0		9·2
17				20·0		8·4
18				22·0		7·6
19				23·0		6·8
20	2·5	6·7		24·0		6·0
21		7·0		25·0	2·4	5·2
22		7·0		26·0		4·9
23		7·5	3·1	27·0		4·6
24		8·0		22·0	2·35	4·4
25		8·0		17·0		4·3
26		8·5	2·7	11·0		4·2
27		9·0		10·5		4·1
28		9·5		10·0		4·0
29		10·0		9·5		3·9
30		10·5		9·0		3·8
31		11·0				3·7

Daily Gauge Heights and Discharges of Norton Creek near Norton lake for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	3·6	....	2·2	....	2·7	....	2·7	2·5	6·7	....	16·0
2	....	3·5	....	2·1	....	2·7	2·2	2·7	....	6·4	....	16·0
3	....	3·4	....	2·0	....	2·7	....	2·9	....	6·1	2·85	16·0
4	....	3·3	....	2·0	....	2·7	....	3·0	....	5·8	....	15·0
5	....	3·2	2·1	1·9	....	2·7	....	3·2	....	5·5	....	14·0
6	....	3·1	....	1·8	....	2·7	....	3·4	2·4	5·2	....	12·5
7	....	3·0	2·07	1·7	2·2	2·7	....	3·5	....	12·0	2·7	11·0
8	....	2·9	....	1·6	....	2·7	2·3	3·7	....	20·0	....	10·0
9	....	2·8	....	1·5	....	2·7	....	4·4	....	28·0	2·6	8·6
10	....	2·7	....	1·4	....	2·7	....	5·1	3·3	36·0	....	8·3
11	2·2	2·7	....	1·3	2·2	2·7	....	5·8	....	34·0	....	7·9
12	....	2·6	....	1·2	....	2·7	....	6·5	....	32·0	....	7·5
13	....	2·5	2·0	1·2	....	–·7	....	7·2	....	30·0	....	7·1
14	....	2·24	....	2·6	2·2	2·7	2·55	7·7	....	28·5	2·5	6·7
15	....	2·3	....	4·0	....	3·0	....	8·0	3·1	27·0	....	6·7
16	....	2·2	....	5·4	....	3·2	....	8·2	....	25·0	....	6·7
17	....	2·0	....	6·8	....	3·4	....	8·4	....	22·0	....	6·7
18	2·1	1·9	....	8·2	....	3·6	2·6	8·6	....	19·0	....	6·7
19	....	1·9	....	9·6	2·3	3·7	....	8·6	2·85	16·0	2·5	6·7
20	....	2·0	2·7	11·0	....	3·5	....	8·6	....	17·0	....	6·7
21	....	2·0	....	9·4	....	3·3	....	8·6	....	17·0	....	6·7
22	....	2·0	....	7·8	2·25	3·2	2·5	8·6	....	17·5	....	6·7
23	....	2·0	....	6·2	....	3·0	....	8·4	2·	18·0	....	6·7
24	....	2·1	....	5·6	....	2·9	....	8·2	....	19·0	2·5	6·7
25	....	2·1	2·2	2·7	....	2·8	....	8·0	....	19·5	2·5	6·7
26	....	2·1	....	2·7	2·2	2·7	....	7·8	....	20·0	....	6·5
27	....	2·2	....	2·7	....	2·7	....	7·6	....	21·0	....	6·3
28	....	2·2	....	2·7	....	2·7	....	7·4	3·0	22·0	2·45	6·0
29	....	2·2	....	....	....	2·7	....	7·2	....	19·0	....	6·1
30	2·15	2·3	....	....	....	2·7	....	7·0	2·85	16·0	....	6·2
31	....	2·3	....	....	....	2·7	....	....	2·85	16·0	....	....

Daily Gauge Heights and Discharges of Norton Creek near Norton lake for 1913—*Concluded.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge	Gauge Height.	Discharge	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	6·3	....	0·8	....	10·0	....	1·9	....	3·1	....	21·0
2	....	6·4	1·85	0·5	....	15·0	....	1·5	....	3·7	....	16·0
3	....	6·5	....	0·5	....	20·0	2·0	1·2	....	4·1	....	11·0
4	....	6·6	....	0·5	....	25·0	....	1·2	....	4·5	2·6	8·6
5	2·5	6·7	1·85	0·5	3·15	30·0	....	1·2	....	4·9	....	8·8
6	....	7·0	....	0·5	2·9	18·0	....	1·2	....	5·5	....	9·0
7	2·53	7·3	....	0·5	2·8	14·0	....	1·2	....	6·1	....	9·2
8	2·45	5·9	....	0·5	....	12·0	....	1·2	2·5	6·7	....	9·4
9	2·45	5·9	1·85	0·5	....	10·0	2·0	1·2	....	6·5	....	9·6
10	....	5·6	....	0·5	2·6	8·6	....	4·8	....	6·3	....	9·8
11	....	5·4	....	0·5	2·55	7·7	2·6	8·6	....	6·2	....	10·0
12	2·4	5·2	....	0·5	....	5·2	3·53	47·0	....	6·1	....	10·2
13	....	5·0	....	0·5	2·2	2·7	3·65	52·5	2·45	6·0	....	10·4
14	....	4·6	....	0·5	2·2	2·7	....	40·0	....	11·0	....	10·5
15	....	4·2	1·85	0·5	....	2·6	....	27·0	....	16·0	....	10·6
16	2·3	3·7	1·85	0·5	....	2·4	2·8	11·0	....	21·0	....	10·7
17	2·3	3·7	....	1·0	....	2·2	....	13·0	....	26·0	....	10·8
18	....	3·2	....	1·5	....	2·0	....	12·0	....	31·0	....	10·9
19	2·2	2·7	2·1	1·9	2·1	1·9	....	11·0	....	36·0	2·7	11·0
20	....	2·4	....	1·5	....	1·8	....	10·0	....	41·0	....	10·6
21	....	2·1	....	1·0	....	1·7	....	8·0	....	46·0	....	10·2
22	2·1	1·9	1·9	0·7	....	1·7	....	7·0	....	51·0	....	9·8
23	2·1	1·9	....	0·7	2·06	1·6	....	6·0	....	56·0	....	9·4
24	....	1·6	....	0·7	....	1·5	....	5·0	3·8	60·0	....	9·0
25	....	1·3	....	0·7	....	1·4	2·23	3·0	4·0	69·0	....	8·6
26	1·95	1·0	....	0·7	2·0	1·2	....	2·7	3·5	46·0	....	8·2
27	....	1·0	1·9	0·7	....	1·7	....	2·4	....	41·0	....	7·8
28	....	1·1	....	0·7	....	2·2	....	2·1	....	36·0	....	7·4
29	....	1·1	....	0·7	2·2	2·7	2·1	1·9	....	31·0	....	7·0
30	2·0	1·2	1·9	0·7	2·15	2·3	2·1	1·9	....	26·0	2·5	6·7
31	2·0	1·2	....	5·0	....	....	....	2·5	....	....	....	6·4

RAINBOW CREEK.

Location.—Below falls, near mouth, in section 18, township 6, range 4, west of 7th meridian.

Records Available.—Continuous records from November 1, 1912, to November 31, 1913.

Winter Conditions.—Open water all season.

Gauge.—Vertical staff gauge—gauge readings about once a week.

Channel.—Permanent rocky channel.

Discharge Measurements.—Two measurements in 1911, two in 1912, and two in 1913 show good agreement, and cover all but the highest stages.

Accuracy.—The infrequency of the guage readings will tend to impair the accuracy of the results.

RAINBOW CREEK.

Rainbow creek has its source in the mountains on the east side of Pitt lake, outside the Railway Belt, at an elevation of 2,000 feet, and discharges into Pitt lake at an elevation of 10 feet. It is part of the Pitt-Fraser drainage. The drainage area is estimated at 20 square miles, and the annual precipitation at about 70 inches. The watershed of Rainbow creek is comparatively high, rocky, and wooded, with snow most of the year in the higher altitudes.

It would be possible to develop power on Rainbow creek, there being a 630-foot fall in half a mile near the mouth. There is said to be a lake near the headwaters which might be utilized as a storage reservoir. There is a small flat at the mouth which would provide plenty of room for a power-house.

The gauging station on Rainbow creek was established on November 11, 1911, by C. G. Cline, and a year's records have been obtained. It is about 2 miles above Goose island, on the east side of Pitt lake. The gauge is a vertical staff, 7 feet long, and is fastened to a stump, 100 feet below the high fall, and 300 yards from the mouth of the creek. The datum of the gauge is referred to three bench-marks. Measurements are made by wading, except at high water, when a boat is used. The station is just at the edge of a pool at the bottom of the fall.

Discharge Measurements of Rainbow Creek below falls, 1911, 12, 13.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
1911.							
Nov. 11	C. G. C. & K. H. S.	1,053	42	61	0·7	0·82	46·0
Dec. 28	K. H. Smith	1,057	36	43	1·2	0·85	51·0
1912.							
Aug. 7	C. G. Cline	1,046	33	46	0·7	0·64	32·4
Nov. 2	C. G. Cline	1,046	36	75	1·0	0·15	74·6
1913.							
May 24	C. G. Cline	1,044	75	310	1·3	2·3	412
July 16	K. G. C. & C. G. C	1,055	42	76	2·2	1·55	166

Monthly Discharge of Rainbow Creek near mouth for 1912.

Month.	Discharge in Second-Feet.			Run-Off.
	Maximum.	Minimum.	Mean.	Total in acre-feet.
November	133	33	75·6	4,498
December	158	62	101·0	6,210

Monthly Discharge of Rainbow Creek at mouth for 1913.

(Drainage area, 20 square miles.)

Month.	Discharge in Second-Feet.			Run-Off.		
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
January	120	34	60·4	3·02	3·48	3,710
February	123	34	70	3·5	3·6	3,890
March	133	41	79·0	3·95	4·55	4,860
April	195	46	95·1	4·75	5·3	5,660
May	450	210	289	14·4	16·6	17,800
June	456	267	298	14·9	16·6	17,700
July	225	117	159	7·95	9·16	9,780
August	404	46	158	7·90	9·11	9,720
September	560	62	169	8·45	9·43	10,060
October	990	30	252	12·6	14·5	15,500
November	990	160	546	27·3	30·5	32,500

Note.—Accuracy "B".

DAILY GAUGE HEIGHTS AND DISCHARGES of Rainbow creek near Mouth for 1912.

Day.	August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height	Discharge	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1							1·05	74	·95	62
2								81		63
3								88		64
4								95		65
5								102		65
6								109		66
7								116		67
8								123	1·00	67
9	·60	30						129		75
10							1·40	133		83
11								124		91
12								115		99
13	2·50	474						106		107
14							1·20	96		114
15								86	1·35	123
16	·90	56						76		119
17							·90	56		115
18								52		111
19	·90	56						47		107
20								42		103
21							·70	37		99
22	·80	46						36	1·20	96
23								34		103
24	·90	56					·65	33		110
25								37		117
26								41		124
27								45		131
28								49		138
29								53	1·45	144
30								57		151
31										158

Daily Gauge Heights and Discharges of Rainbow Creek near mouth for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-fy	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	120	0·7	37	....	91	....	55	....	210	2·45	456
2	....	110	....	37	1·2	96	....	60	....	225	....	429
3	....	100	....	36	....	92	....	65	....	235	....	400
4	....	90	....	36	....	88	....	70	1·85	251	....	375
5	1·1	81	....	36	....	84	....	75	....	258	....	350
6	....	74	....	35	....	80	1·1	81	....	265	....	320
7	....	67	....	35	....	76	....	77	....	272	....	295
8	....	61	....	34	....	72	....	73	....	279	1·9	267
9	....	55	0·65	34	1·0	67	....	68	....	286	....	270
10	....	49	....	47	....	75	....	62	....	293	....	272
11	....	43	....	60	....	83	....	57	2·0	301	....	275
12	0·7	37	....	73	....	91	....	53	....	295	....	277
13	....	37	....	86	....	99	....	49	....	290	....	279
14	....	37	....	100	....	107	0·8	46	....	285	....	282
15	....	36	....	112	....	115	....	55	....	280	1·95	284
16	....	36	1·35	123	1·4	133	....	65	....	275	....	281
17	....	35	....	115	....	122	....	75	....	270	....	278
18	....	35	....	107	....	111	....	85	1·9	267	....	275
19	0·65	34	....	99	....	100	....	95	....	289	....	272
20	....	37	....	91	....	89	1·25	105	....	311	....	270
21	....	40	....	83	....	78	....	112	....	333	1·9	267
22	....	43	....	75	....	67	....	119	....	355	....	269
23	0·8	46	1·0	56	0·9	56	....	126	....	377	....	271
24	....	63	....	71	....	53	....	133	2·3	410	....	273
25	....	30	....	75	....	50	....	140	2·35	422	....	275
26	1·2	96	....	79	....	48	....	147	....	425	....	277
27	....	86	....	83	....	46	1·5	155	....	430	....	279
28	....	76	....	87	....	43	....	170	....	435	....	281
29	....	66	....	....	0·75	41	....	185	....	440	1·95	284
30	....	56	....	....	....	45	....	195	....	445	....	279
31	....	46	....	....	....	50	....	....	....	450	....	....

DAILY GAUGE HEIGHTS AND DISCHARGES of Rainbow Creek near Mouth for 1913—*Concluded.*

Day.	July		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1		255	1·3	113		267		60		160		
2		240		106		339		53		190		
3		225		99		411		47		220		
4		210		92		483		38		250		
5		195		84	2·75	560	0·6	30		270		
6	1·6	180		77		444		165		300		
7		167		69	2·05	318		300		320		
8		153		61		272		435		350		
9		138		54		237		570	2·2	370		
10	1·35	123	0·8	46		202		705		410		
11		130		105		167		840		450		
12		138		155		132	4·0	990		490		
13		146		205		97		820		530		
14		154		255	0·95	62		670		570		
15		160		305		62		520		600		
16	1·55	167		355		62		370	3·0	646		
17		165	2·3	404		62		220		700		
18		162		360		62	1·0	67		750		
19		160		320		62		67		800		
20		157		280		62		65		850		
21	1·5	155		240	0·95	62		63		900		
22		152		200		65		62		950		
23		148		150		68		60	4·0	990		
24		145	1·2	96		71		58		910		
25		141		87		74		56		820		
26		137		78		76		54		730		
27	1·4	133		69		78		52		630		
28		129		60	1·1	81	0·85	51		520		
29		125	0·85	51		74		80		400		
30		120		123		67		110	2·05	318		
31		117		195				140				

RAVEN (RUSHTON) CREEK.

Location.—Below canyon near mouth in section 18, township 5, range 4, west of 7th meridian.

Records Available.—Continuous records from November 3, 1912, to November, 30, 1913.

Winter Conditions.—Open water all season.

Gauge.—Vertical staff gauge. Three readings a week.

Channel.—Permanent rocky channel.

Discharge Measurements.—One measurement in 1912 and four in 1913 show good agreement but do not cover the higher stages.

Accuracy.—The infrequency of the gauge readings and the absence of a flood measurement will tend to impair the accuracy of the work.

RAVEN (RUSHTON) CREEK.

Raven (or Rushton) creek rises in Rushton lake at an elevation of 700 feet, and discharges into Pitt lake on the east side opposite Goose island, at an elevation of about 10 feet. It is part of the Pitt Fraser drainage. The watershed is in the Coast district, with a mean annual precipitation of something like 60 inches. The stream does not freeze over at the mouth, but in the higher altitudes the winter conditions are more severe.

Mr. E. J. Fader, of New Westminster, proposes to develop power on Rushton creek. Rushton lake is 700 feet above Pitt lake and only three quarters of a mile distant. Below the lake there is a fall of about 100 feet high, and only one quarter mile from Pitt lake. The water is to be diverted above the fall and conveyed in a flume and pipeline to the power-house near Pitt lake. Rushton lake could be used for storage. The power is to be used to run a quarry and gravel-screening plant.

A gauging station was established on Rushton creek on November 3, 1912, and gauge readings were taken three times a week for a year. There is a vertical staff gauge just at the lower end of the canyon below the fall, and one quarter mile from Pitt lake. The meter measurements are made by wading at a section 100 feet below the gauge. During the season of 1913 sufficient meter measurements were taken to locate the rating curve.

Discharge Measurements of Raven Creek (Rushton) near Mouth 1912 and 1913.

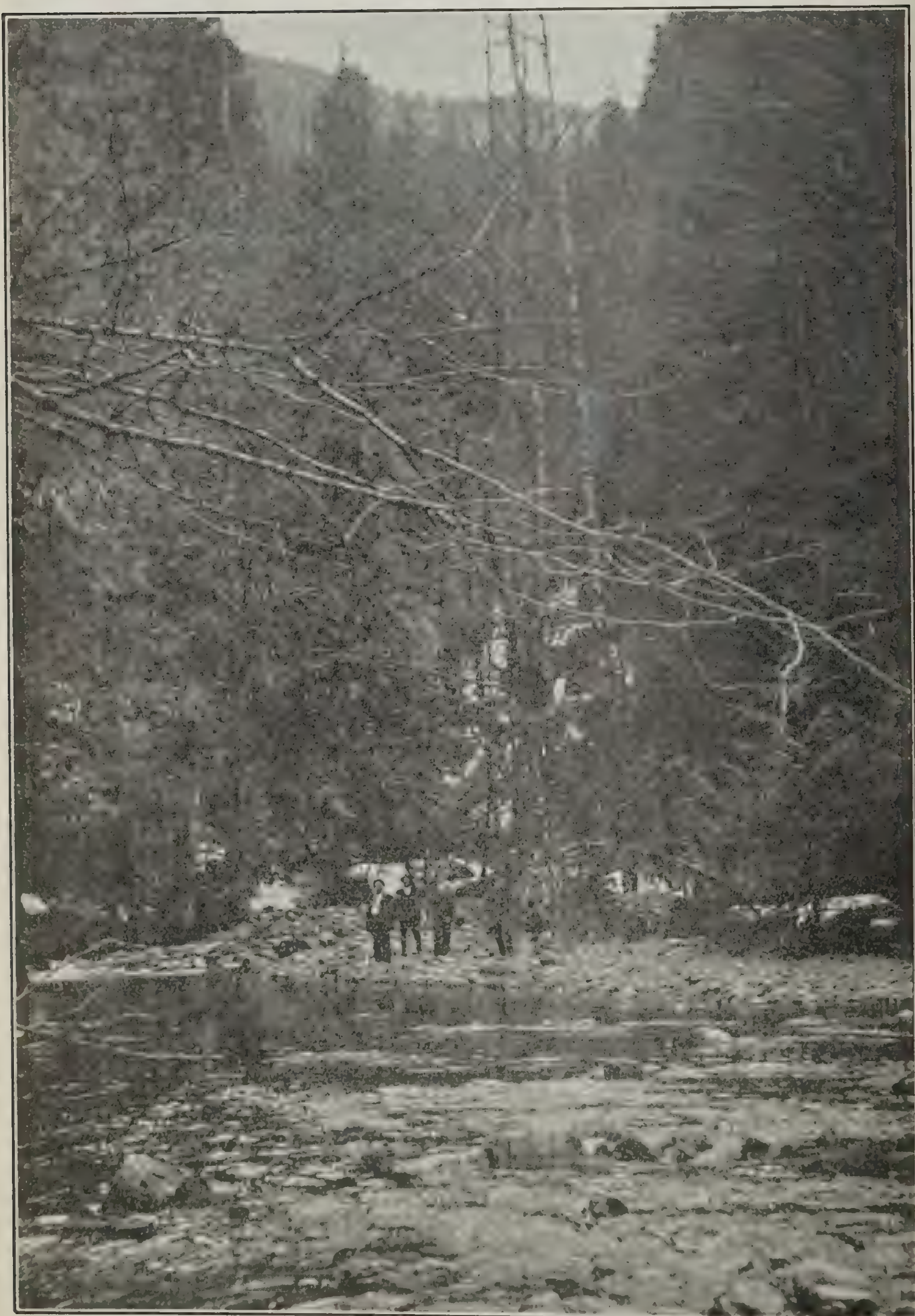
Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
1912							
Nov. 3	C. G. Cline	1046	32	54	1·2	2·18	63·6
1913							
May 24	C. G. Cline	1044	32	67	2·0	2·57	135·0
July 16	K. G. C. & C. G. C.	1055	30	52	0·9	2·02	46·5
Sept. 17	K. G. Chisholm	1055	15	27	0·8	1·69	20·9
Oct. 26	H. J. E. Keys	1057	30	42	0·6	1·80	25·0

Monthly Discharge of Rushton Creek near Mouth for 1912.

Month.	Discharge in Second-Feet.			Run-off.
	Maximum.	Minimum.	Mean.	Total in acre-feet.
November	150	17	75	4,469
December	80	19	48	2,957

Monthly Discharge of Raven (Rushton) Creek near Mouth for 1913.

Month.	Discharge in Second-Feet.			Run-off.
	Maximum.	Minimum.	Mean.	Total in acre-feet.
January	50	5	15·9	977
February	140	13	42·7	2,370
March	120	17	42·3	2,600
April	140	15	56·1	3,340
May	150	31	89·6	5,510
June	160	27	76·4	4,550
July	72	21	40·0	2,640
August	185	7	42·0	2,580
September	620	8	86·1	5,120
October	620	13	120·0	7,380
November	620	21	201·0	12,000



Raven Creek near Metering Station.

Raven Creek—Gravel Deposits at mouth.

DAILY GAUGE HEIGHTS AND DISCHARGES of Raven (Rushton) Creek near Mouth for 1912.

Day.	November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	80	....	29
2	....	80	1·9	35
3	2·2	65	....	60
4	....	85	2·3	80
5	2·4	100	....	55
6	....	80	1·85	31
7	2·2	65	....	28
8	....	55	....	25
9	2·0	45	1·7	21
10	....	75	....	20
11	2·4	100	1·65	19
12	....	125	....	23
13	2·65	150	1·8	27
14	....	115	....	35
15	2·3	80	....	42
16		100	2·05	50
17	....	120	....	58
18	2·6	140	2·2	65
19	....	120	....	57
20	2·4	100	2·05	50
21	....	85	....	48
22	....	70	....	46
23	2·05	50	2·0	45
24	....	38	....	55
25	1·8	27	2·2	65
26	....	23	....	73
27	1·65	19	2·3	80
28	....	17	....	75
29	1·55	15	....	70
30	....	22	2·2	65
31	....	....	....	65

Daily Gauge Heights and Discharges of Raven (Rushton) Creek Canyon near Mouth for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	3·05	50	....	16	....	17	....	55	....	55	....	150
2	....	40	....	22	....	22	2·20	65	....	55	2·70	160
3	1·85	31	1·80	27	1·30	27	....	60	2·40	100	....	140
4	....	26	....	24	....	22	2·10	55	....	85	2·50	120
5	....	21	1·70	21	1·60	17	....	50	2·20	65	....	105
6	1·60	17	....	18	....	20	....	45	....	55	2·35	90
7	....	15	1·55	15	1·75	24	1·95	40	....	45	....	100
8	1·50	13	....	16	....	27	....	30	1·85	31	....	110
9	....	12	....	16	....	31	1·70	21	....	56	2·15	120
10	1·40	10	1·60	17	1·90	35	....	18	2·30	80	....	100
11	....	9	....	19	....	31	1·55	15	....	115	2·30	80
12	....	8	1·70	21	1·80	27	....	17	2·65	150	....	62
13	1·20	7	....	50	....	24	....	19	....	110	2·00	45
14	....	7	2·30	80	1·70	21	1·70	21	2·25	72	....	42
15	1·10	6	....	100	....	40	....	24	....	80	....	39
16	....	5	....	120	....	60	1·80	27	2·35	90	1·90	35
17	1·05	5	2·60	140	2·30	80	....	33	....	81	....	47
18	....	6	....	110	....	100	1·95	40	....	73	2·15	60
19	....	6	2·30	80	2·50	120	....	48	2·20	65	....	90
20	1·20	7	....	60	....	100	....	56	....	82	2·00	115
21	....	8	2·00	45	2·30	80	2·20	65	2·40	100	....	65
22	1·30	8	....	40	....	65	....	78	....	110	1·80	27
23	....	15	....	35	....	40	2·35	90	....	120	....	36
24	1·80	27	1·85	31	1·90	35	....	100	2·55	130	....	45
25	....	26	....	25	....	28	2·45	110	....	120	2·10	55
26	....	25	1·65	19	1·70	21	....	125	....	110	....	45
27	1·75	24	....	16	....	28	2·60	140	....	100	1·90	35
28	....	20	1·50	13	1·90	35	2·45	110	....	90	....	50
29	1·55	15	....	....	....	38	....	80	2·30	80	2·25	70
30	....	12	....	....	....	42	2·00	45	....	110	....	55
31	1·40	10	....	....	2·00	45	....	....	2·60	140	....	....

Daily Gauge Heights and Discharges of Raven (Rushton) Creek Canyon near Mouth for 1913—*Concluded.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	2·00	45	1·80	27	2·20	65	1·50	13	.....	21	.....	.....
2	.....	60	.....	24	.....	345	.....	16	1·70	21	.....	.....
3	2·25	72	1·70	21	3·90	620	1·65	19	.....	24	.....	.....
4	.....	60	.....	19	.....	420	.....	16	1·80	27	.....	.....
5	.....	50	.....	17	3·15	255	1·50	13	.....	77	.....	.....
6	1·90	35	1·55	15	.....	195	.....	50	.....	127	.....	.....
7	.....	32	.....	14	2·50	120	.....	90	2·40	100	.....	.....
8	.....	29	1·50	13	.....	100	2·55	130	.....	200	.....	.....
9	1·80	27	.....	11	.....	75	.....	365	3·00	225	.....	.....
10	.....	24	1·30	8	2·05	50	4·80	600	.....	160	.....	.....
11	1·70	21	.....	13	.....	35	.....	610		100	.....	.....
12	.....	27	.....	18	1·70	21	4·90	620	2·00	45	.....	.....
13	.....	33	1·80	27	.....	17	.....	420	.....	43	.....	.....
14	.....	40	.....	55	1·45	12	.....	200	1·95	40	.....	.....
15	.....	45	3·30	80	.....	17	2·25	72	.....	220	.....	.....
16	2·05	50	.....	130	.....	22	.....	62	3·80	390	.....	.....
17	.....	53	2·30	185	1·80	27	.....	54	.....	280	.....	.....
18	2·10	55	.....	150	.....	22	2·00	45	.....	170	.....	.....
19	2·20	65	.....	110	1·60	17	.....	38	2·00	45	.....	.....
20	.....	55	2·30	80	.....	15	.....	31	.....	50	.....	.....
21	2·00	45	.....	60	1·50	13	.....	24	2·10	55	.....	.....
22	.....	40	1·90	35	.....	15	1·60	17	.....	330	.....	.....
23	1·90	35	.....	30	.....	17	.....	20	4·90	620	.....	.....
24	.....	29	1·70	21	1·65	19	.....	22	.....	580	.....	.....
25	1·75	24	.....	19	.....	15	.....	24	4·30	495	.....	.....
26	.....	30	.....	16	1·30	8	1·80	27	.....	420	.....	.....
27	1·90	35	1·50	13	.....	10	.....	25	3·60	350	.....	.....
28	.....	33	.....	10	1·45	12	1·75	24	.....	300	.....	.....
29	.....	32	1·25	7	.....	12	.....	23	.....	250	.....	.....
30	1·85	31	.....	27	.....	13	.....	22	2·85	195	.....	.....
31	.....	29	.....	47	.....	.....	1·70	21	.....	.....	.....	.....

SILVER HOPE CREEK.

Location.—This stream is measured in two branches, and the results are combined to give the total discharge . The stations are located near the highway bridges near the mouth of the stream in section 5, township 5, range 26, west of 6th meridian.

Records Available.—Continuous records from December 11, 1911, to December 11, 1913.

Winter Conditions.—Open water all season.

Gauge.—Vertical staff gauges—daily readings.

Channel.—Permanent rocky channels. water swift at higher stages.

Discharge Measurements.—Some half a dozen measurements on both branches show a fair agreement and cover most stages of the two branches.

Accuracy.—Fair.

SILVER HOPE CREEK.

Silver Hope creek has its source in the mountains 15 miles south of Hope at an elevation of from two to three thousand feet, and discharges into the Fraser river near Hope at an elevation of about 100 feet. It is part of the Fraser river drainage; the drainage area, as measured from a Dominion sectional map, scale 3 miles to 1 inch, is 80 square miles. The precipitation varies from 50

inches at the mouth to 80 inches or more in the upper section of the watershed, where the winters are severe, with much snow. At present a very small amount of water from this creek is used for irrigation; there is some good land along the Fraser near the mouth of the creek, but with that exception there is little agricultural land in the Silver Creek valley, and none is taken up. The hillsides are very steep, which tends to give a rapid run-off, with small loss by evaporation and seepage. The creek is swift, with many rapids, but the fall is uniformly distributed through its whole length.

The creek is fairly well controlled by Silver lake, about 5 miles from the mouth of the creek, at an altitude of 1,100 feet. The lake has an area of 160 acres, and would afford a suitable reservoir for power development. But this stream is a poor power proposition when compared with others in the same district still undeveloped.

Attempts have been made to build a railroad up the valley, but the grade was found to be too steep. The Pacific highway, however, is now being built through the valley, and will give easy access to this district, which is unrivalled in its primitive beauty.

In establishing a gauging station on Silver Hope creek, it was found most convenient to locate the station at a point where an island divides the creek into two channels. This necessitated the use of two gauges, one on each branch. The sum of the discharges of the two branches represent the total flow of Silver Hope creek. The station was established November 17, 1911, by C. G. Cline, and gauge readings were taken regularly till December, 1913, giving two years records. It is located one half a mile from the mouth, and one quarter of a mile above the C.N.R. bridge. Vertical staff gauges are located on both branches; on the left branch the gauge is fastened to the left abutment of the highway bridge on the upstream side; on the right branch the gauge is fastened to a tree on the right bank 100 feet below the highway bridge. The measuring section on the right branch is 5 feet below the gauge; a tree was felled across the stream, and cable measurements are taken from it. The measuring section on the left branch is at the bridge during high water, when cable measurements are made; during lower water, wading measurements are made 100 feet below the bridge.

Discharge Measurements of Silver Hope River at Mouth 1911-13

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
	Right Branch.						
1911							
Dec. 11......	Smith......................	1057	43	57·1	3·4	2·40	196
1912							
Mar. 1......	C. G. Cline..................	1046	35	74	1·94	1·90	146
June 7......	do	1046	46	127	6·02	3·50	765
Sept. 17......	do	1046	40	61	1·76	1·73	108
Nov. 19......	do	1048	46	134	4·86	3·35	652
Dec. 7......	do	1048	40	84	2·37	2·25	199
1913							
May 16......	do	1044	46	124	4·54	3·18	563
June 23......	do	1044	30	141	6·59	4·00	930
Sept. 10......	K. G. Chisholm..............	1055	30	99	3·28	2·77	324
	Left Branch.						
1911							
Dec. 11......	Smith......................	1057	40	52·2	3·4	1·00	177
1912							
Mar. 1......	C. G. Cline..................	1046	30	55·7	·97	0·55	54
June 7......	do	1046	41	82·0	4·1	1·70	335
Sept. 17......	do	1046	34	30·5	·83	0·20	25
Nov. 19......	do	1048	41	65·1	3·38	1·35	216
Dec. 7......	do	1048	39	37	1·16	0·48	43
1913							
May 16......	C. G. Cline..................	1044	45	80	2·68	1·35	214
July 22......	K. G. Chisholm..............	1055	40	75·7	3·62	1·45	275
July 23......	"	1044	40	82·5	4·29	1·62	354
Sept. 10......	"	1055	52	50·2	1·76	0·71	88
Oct. 14......	H. J. E Keys................	1057	39	45·7	3·80	1·20	178

Monthly discharge of Silver Hope Creek Island, near mouth, for 1913.

(Drainage Area 80 Square Miles.)

Month.	Discharge in Second-Feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per Square Mile.	Depth in inches on Drainage Area.	Total in Acre-feet.
January..................................	281	124	169·6	2·12	2·44	10,000
February.................................	1,277	126	274·9	3·44	3·58	15,300
March....................................	330	165	213·9	2·67	3·08	13,200
April.....................................	910	161	447·1	5·59	6·24	26,600
May......................................	1,950	309	1,049·5	13·1	15·10	64,500
June.....................................	3,050	1,155	1,763·5	22·0	24·50	105,000
July......................................	1,555	561	1,048·4	13·1	15·10	64,500
August...................................	621	236	383·6	4·79	5·52	23,600
September................................	1,390	222	395·4	4·94	5·51	23,500
October..................................	3,000	161	637·9	7·98	9·20	39,200
November.................................	2,375	222	557·7	6·97	7·78	33,100

Note.—Accuracy "A" and "B".

DAILY GAUGE HEIGHTS AND DISCHARGES of Silver Hope Creek Island near mouth for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	215	....	161	....	184	....	184	....	377	....	2,355
2	....	215	....	153	....	176	....	168	....	357	....	2,675
3	....	240	....	150	....	165	....	168	....	333	....	3,050
4	....	220	....	140	....	165	....	161	....	333	....	2,830
5	....	192	....	133	....	176	....	172	....	309	....	2,030
6	....	180	....	132	....	176	....	172	....	333	....	1,685
7	....	180	....	139	....	200	....	172	....	425	....	1,960
8	....	180	....	132	....	226	....	172	....	756	....	2,080
9	....	172	....	129	....	250	....	172	....	1,515	....	1,850
10	....	161	....	126	....	269	....	192	....	1,325	....	1,535
11	....	161	....	126	....	269	....	316	....	1,138	....	1,575
12	....	155	....	126	....	257	....	578	....	1,091	....	1,645
13	....	200	....	126	....	225	....	650	....	1,020	....	2,080
14	....	281	....	126	....	250	....	555	....	874	....	1,805
15	....	161	....	165	....	220	....	555	....	828	....	1,390
16	....	153	....	813	....	210	....	495	....	769	....	1,390
17	....	124	....	1,227	....	288	....	515	....	741	....	1,280
18	....	124	....	744	....	330	....	578	....	701	....	1,155
19	....	133	....	505	....	276	....	800	....	843	....	1,645
20	....	135	....	404	....	225	....	800	....	874	....	2,295
21	....	124	....	356	....	210	....	910	....	874	....	1,695
22	....	128	....	300	....	210	....	859	....	1,138	....	1,515
23	....	133	....	262	....	200	....	613	....	1,747	....	1,515
24	....	128	....	235	....	196	....	515	....	1,950	....	1,447
25	....	158	....	210	....	184	....	495	....	1,927	....	1,390
26	....	192	....	200	....	184	....	555	....	1,815	....	1,390
27	....	168	....	188	....	184	....	555	....	1,950	....	1,430
28	....	158	....	188	....	184	....	495	....	1,657	....	1,515
29	....	165	....	....	....	168	....	439	....	1,370	....	1,390
30	....	161	....	....	....	180	....	401	....	1,370	....	1,390
31	....	161	....	....	....	196	....	....	....	1,792	....	....

DAILY GAUGE HEIGHTS AND DISCHARGES of Silver Hope Creek Island near mouth for 1913—*Concluded.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	1,447	....	621	....	222	....	212	....	380	....	510
2	....	1,210	....	621	....	222	....	212	....	339	....	450
3	....	1,047	....	595	....	222	....	212	....	319	....	410
4	....	948	....	561	....	1,060	....	212	....	222	....	364
5	....	1,140	....	507	....	1,390	....	202	....	337	....	364
6	....	1,260	....	497	....	1,155	....	178	....	364	....	326
7	....	1,355	....	457	....	585	....	161	....	380	....	364
8	....	1,210	....	497	....	448	....	202	....	341	....	337
9	....	1,140	....	497	....	457	....	226	....	364	....	322
10	....	1,310	....	404	....	430	....	226	....	464	....	322
11	....	1,260	....	387	....	404	....	3,000	....	410	....	307
12	....	1,060	....	387	....	340	....	2,650	....	364	....	....
13	....	1,155	....	370	....	319	....	[illegible],105	....	322	....	....
14	....	961	....	348	....	319	....	1,270	....	322	....	....
15	....	781	....	390	....	300	....	915	....	304	....	....
16	....	881	....	326	....	281	....	711	....	2,375	....	....
17	....	864	....	326	....	269	....	576	....	1,180	....	....
18	....	900	....	412	....	326	....	510	....	799	....	....
19	....	1,060	....	370	....	286	....	576	....	526	....	....
20	....	1,210	....	326	....	269	....	576	....	464	....	....
21	....	1,440	....	286	....	252	....	510	....	457	....	....
22	....	1,320	....	286	....	319	....	482	....	410	....	....
23	....	1,140	....	307	....	300	....	640	....	400	....	....
24	....	1,047	....	307	....	257	....	1,015	....	845	....	....
25	....	940	....	286	....	240	....	677	....	845	....	....
26	....	830	....	286	....	226	....	510	....	711	....	....
27	....	735	....	257	....	226	....	489	....	711	....	....
28	....	697	....	252	....	252	....	410	....	632	....	....
29	....	864	....	252	....	240	....	380	....	632	....	....
30	....	621	....	236	....	226	....	360	....	510	....	....
31	....	561	....	236	....	....	....	337	....	....	....	....

SILVER PITT CREEK.

Location.—At lower end of canyon, about 2 miles from mouth of creek, in section 8, township 4, range 5, west of 7th Meridian.

Records Available.—Continuous since August 9, 1912.

Winter Conditions.—Open water all season.

Gauge.—Vertical staff gauge, readings three times a week.

Discharge Measurements.—One measurement in 1912 and five in 1913 show fair agreement.

Accuracy.—Records are not as reliable as though readings had been taken daily.

SILVER PITT CREEK.

Silver Pitt creek rises in the hills between Coquitlam lake and Pitt lake at an elevation of about 3000 feet; and flows from the west into Pitt river near Pitt lake at an elevation of 10 feet. It is part of the Pitt-Fraser drainage. About 3 miles from its mouth the stream flows out through a canyon on to a flat where it has numerous branches and frequently changes its channels. In the last mile of its course it forms a slough in which the water rises and falls with the water in Pitt river under the influence of the tides.

There is a considerable extent of good agricultural land in the flat near the mouth. Much of this land, however, is frequently flooded by the freshets in Silver creek and submerged by the high water in Pitt river. The homesteaders are planning to combine to have the land dyked and drained.

The watershed is in the Coast district, with a mean annual precipitation of about 80 inches. The stream does not freeze over near its mouth in the winter, but near the headwaters the winter conditions are more severe.

The Municipality of Coquitlam is preparing to install a waterworks system which will draw its water supply from this stream near the canyon mentioned above.

A gauging station was established on Silver Pitt creek on August 9, 1912, and gauge readings are being taken about three times a week. The station is at the lower end of the canyon and measures the whole flow of the stream. The gauge is a 6 foot vertical staff nailed to the upstream side of a 16 inch hemlock tree on the left bank of the stream. The meter measurements are made by wading at a section 5 feet above the gauge. A cable has been installed for use in high water. There is a deep pool in the canyon above the station, and there are rapids below.

DISCHARGE MEASUREMENTS of Silver Pitt Creek, Mouth of Canyon 1912-13

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
1912							
Aug. 9	C. G. Cline	1,046	65	104	2·39	1·50	249
1913							
May 25	C. G. Cline	1,044	60	121	3·05	2·15	369
July 15	K. G. Chisholm	1,055	62·5	100	1·83	1·41	184
Sept. 16	do	1,055	57	68	1·35	0·87	92
Sept. 17	do	1,055	55	66	1·27	0·80	84
Oct. 25	H. J. E. Keys.	1,057	61	73·5	1·60	0·99	116

MONTHLY DISCHARGE of Silver Pitt Creek, Mouth of Canyon for 1913.

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
January	125	84	94	1·34	1·54	5,780
February	251	51	111	1·57	1·64	6,160
March	175	90	113	1·61	1·86	6,950
April	335	100	250	3·57	3·98	14,900
May	563	278	347	4·96	5·72	21,300
June	428	196	286	4·09	4·56	17,000
July	322	117	221	3·15	3·63	13,600
August	461	45	164	2·32	2·67	10,000
September	884	45	214	3·05	3·41	12,700
October	1,023	45	242	3·46	3·99	14,900
November	973	105	343	4·90	5·47	20,400
December	428	100	223	3·19	3·68	13,700
The year	1,023	45	217	3·10	42·15	157,400

NOTE.—Accuracy "B", "C" and "D".

Monthly Discharge of Silver Pitt Creek, Mouth of Canyon for 1912.

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
September	262	15	88·1	1·26	1·41	5,240
October	362	35	135·2	1·93	2·22	8,300
November	853	109	322·0	4·59	5·12	19,160
December	285	90	142·5	2·03	2·34	8,730

Note.—Accuracy "B" and "C".

Daily Gauge Heights and Discharges of Silver Pitt River near Mouth of Canyon for 1912.

Day.	August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	....	....	170	....	105	....	148	....	133
2	....	....	....	215	1·1	135	....	172	....	145
3	....	....	1·7	262	....	115	....	200	....	157
4	....	....	....	237	....	95	1·5	218	1·3	175
5	....	....	....	218	0·7	70	....	338	1·0	117
6	....	....	....	197	....	64	2·4	461	0·9	100
7	....	....	1·3	175	....	58	....	370	....	100
8	....	....	....	153	....	52	....	270	....	100
9	1·5	248	....	131	0·5	45	1·3	175	....	130
10	1·7	262	....	100	....	42	....	270	....	160
11	1·4	196	0·8	84	....	39	2·1	362	....	190
12	0·8	84	....	75	0·4	35	....	607	....	220
13	0·5	45	....	66	....	35	3·6	853	....	250
14	....	55	0·6	57	....	35	....	620	1·8	285
15	....	65	....	52	0·4	35	....	400	1·25	165
16	....	75	....	47	....	55	1·3	175	1·3	175
17	....	85	....	42	....	75	....	255	1·1	135
18	0·9	100	0·4	35	....	95	....	335	....	135
19	....	88	....	32	1·0	117	....	415	....	135
20	....	76	....	29	....	177	2·5	494	....	135
21	0·6	57	0·3	25	....	237	....	464	....	126
22	....	52	....	23	....	297	....	424	....	117
23	....	47	....	21	2·1	362	2·1	362	....	117
24	....	42	....	19	....	342	....	312	1·0	117
25	0·4	35	0·2	15	....	322	....	262	0·85	90
26	....	35	....	15	1·9	308	....	212	1·0	117
27	....	35	....	15	....	258	1·1	135	....	117
28	....	35	0·2	15	....	208	1·0	117	....	117
29	0·4	35	....	45	....	158	0·95	109	....	117
30	....	80	....	75	0·9	100	....	121	....	120
31	....	125	....	....	....	124	....	....	......	120

DAILY GAUGE HEIGHTS AND DISCHARGES of Silver Pitt River near Mouth of Canyon for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge	Gauge Height.	Discharge.	Gauge Height.	Discharge	Gauge Height.	Discharge	Gauge Height	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	1·05	122	....	77	....	102	....	100	....	278	....	412
2	0·9	125	....	70	....	110	....	110	....	278	2·3	428
3	0·8	100	....	67	....	118	....	120	....	278	....	398
4	....	84	0·65	63	....	126	1·1	135	....	278	....	368
5	....	84	....	59	....	134	....	165	....	278	....	338
6	....	84	0·55	51	....	146	....	195	....	280	1·9	308
7	....	84	....	51	1·2	155	....	225	1·8	285	1·7	262
8	....	84	....	51	1·3	175	....	255	....	285	....	295
9	....	84	....	71	....	165	....	285	....	295	....	328
10	....	84	....	91	....	150	....	315	....	305	2·1	362
11	....	88	....	101	....	140	2·0	335	....	320	....	335
12	....	88	....	121	....	130	....	325	....	340	1·9	308
13	....	88	....	141	....	120	....	315	....	365	....	285
14	....	88	....	161	....	110	....	365	2·2	395	1·7	262
15	....	88	....	181	....	100	....	293	2·7	563	....	273
16	....	96	....	201	....	100	....	285	....	503	....	284
17	....	96	....	221	....	100	....	277	....	453	....	295
18	....	96	1·65	251	....	100	....	270	....	403	1·9	308
19	....	96	....	211	....	100	1·7	262	2·0	335	....	285
20	....	96	....	171	....	100	....	262	....	343	1·7	262
21	....	100	....	131	....	95	....	262	....	351	....	240
22	....	100	....	91	....	95	....	262	....	359	....	218
23	....	100	0·75	77	....	95	....	262	....	368	1·4	196
24	....	100	0·70	70	....	95	....	262	2·15	378	....	218
25	....	100	....	70	....	95	....	262	....	364	1·6	240
26	....	100	....	78	....	92	....	270	....	350	....	218
27	....	100	....	86	....	92	....	270	....	336	1·4	196
28	0·9	100	....	94	....	92	....	270	....	332	1·4	196
29	0·8	84	....	....	....	92	....	270	1·9	308	....	217
30	....	84	....	....	....	92	....	270	....	351	....	238
31	....	84	....	....	0·85	90	....	....	2·2	395	....	....

Daily Gauge Heights and Discharges of Silver Pitt River near Mouth of Canyon for 1913.

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Dis-charge.	Gauge Height	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	259	1·0	117	1·65	251	0·5	45	....	105	1·8	285
2	1·8	285	....	111	....	567	....	51	0·95	109	....	268
3	....	304	....	105	3·7	884	0·6	57	....	113	1·65	251
4	1·95	322	0·9	100	....	690	....	54	1·0	117	....	223
5	1·85	297	....	92	2·5	495	0·55	51	....	152	1·4	196
6	....	303	0·8	84	....	445	....	121	....	197	....	182
7	1·9	308	....	77	....	390	....	191	1·65	251	....	168
8	....	297	0·7	70	2·0	335	1·7	262	....	230	1·2	155
9	1·8	285	....	62	....	287	....	660	....	208	....	136
10	....	274	....	54	1·6	240	4·0	959	1·35	186	1·0	117
11	....	263	0·5	45	....	195	....	991	....	170	....	111
12	1·65	251	....	81	1·2	155	4·2	1,023	1·2	155	....	105
13	....	229	1·0	117	....	127	....	757	....	145	0·9	100
14	1·45	207	....	167	0·9	100	....	493	1·1	135	....	127
15	....	184	1·5	218	....	92	1·55	229	....	302	1·2	155
16	1·4	196	....	299	0·8	84	....	156	....	469	....	197
17	....	218	....	380	....	80	0·8	84	2·9	629	1·6	240
18	1·6	240	2·4	461	....	75	....	70	....	392	....	334
19	....	225	....	384	0·7	70	0·6	57	1·2	155	2·3	428
20	....	210	1·9	308	....	92	....	66	....	140	....	368
21	1·4	196	....	263	....	114	....	75	1·05	126	1·9	308
22	....	186	1·5	218	1·1	135	0·8	84	....	550	....	286
23	1·3	175	....	197	....	113	....	100	4·05	975	....	263
24	....	165	....	176	0·85	90	1·0	117	....	894	1·6	240
25	1·2	155	1·2	155	....	68	....	114	3·5	821	....	262
26	....	149	....	136	0·5	45	....	112	....	708	1·8	285
27	....	142	1·0	117	....	49	....	110	2·8	596	....	255
28	1·1	135	....	94	....	53	0·95	108	....	505	....	225
29	....	126	0·7	70	0·6	57	....	105	....	425	1·4	196
30	1·0	117	....	130	....	51	....	102	2·0	335	....	218
31	....	117	....	190	....	....	0·9	100	....	....	1·6	240

SOUTH LILLOOET RIVER.

Location.—At upper highway bridge, 8 miles from mouth, in section 28, township 12, east of Coast meridian.

Records Available.—Continuous since October 26, 1911.

Winter Conditions.—Open water all season.

Gauge.—Chain gauge on bridge. Gauge readings daily.

Channel.—Permanent rocky channel.

Discharge Measurements.—Two measurements in 1911, four in 1912, and two in 1913 show good agreement and cover practically all stages.

Accuracy.—Good.

SOUTH LILLOOET RIVER.

The South Lillooet river rises in the Lillooet lakes at an elevation of 370 feet, discharging into Pitt river below Pitt lake at about sea-level. The drainage area of the South Lillooet river is 70 square miles, while that of the Lillooet river (including the North Lillooet) is 105 square miles.

The precipitation in the Lillooet watershed varies from 70 inches per annum at the mouth to 80 inches or more at the headwaters. The stream is at present used for logging, but there are water-power possibilities on it.

The original plan of development of this stream by the Burrard Power Company was the diversion of water from the Lillooet lakes over the divide to Kanaka falls near the Fraser river. The Burnett Lumber Company objected

to the alienation of South Lillooet river water, since the company claimed the right to use the natural flow of the stream for logging purposes. From these objections sprung the famous Burrard Power case, through which the right of ownership of the Dominion of Canada to the water within the Railway Belt of British Columbia was formally established.

Another plan of development is by carrying the water in a 5½-mile flume along the hillsides north of the South Lillooet river to a controlling reservoir, and then by a 1500-foot penstock to a power-house in S.E. ¼ sec. 28, tp. 12, E. C. M., near the North Lillooet river. This would give a head of something like 300 feet, but the flume would be rather expensive.

The upper Lillooet lake is only about a mile from Stave lake, and is 100 feet higher. A short tunnel would permit the diversion of the water into Stave lake, where it would augment the flow available for the Western Canada Power Company's plant. This company has a head of about 100 feet at its present plant, and could use the water again at the lower plant which it proposes to build to take advantage of the remaining 100-foot drop between the upper plant and tidewater.

There are extensive flats on both sides of the South Lillooet river for 7 miles from the mouth, and part of this land is under cultivation at present. It is often flooded, and much of it must be dyked before it can be used for farming. The land is very fertile, and either open or easily cleared. The intermediate part of the watershed is composed of hills and plateaus a few hundred feet high, with very valuable fir and cedar timber. Some of this has been cut, and logging operations are being carried on at present. The logs are run down the river during the freshets, but this method is not very satisfactory. The building of the proposed Vancouver-Mission tram line will probably provide a better means of handling the timber. In the upper part of the watershed there are mountain peaks several thousand feet high, on some of which the snow remains all summer until washed down by the fall rains.

Near the mouth of the stream the water is deep, sluggish, and is affected by the rise and fall of the tides. Higher up it is swift and comparatively shallow.

The station on the South Lillooet river was established on October 26, 1911, by C. G. Cline, and continuous gauge readings have been taken ever since. It is located at the upper highway bridge across the Lillooet river about 2½ miles from Port Haney, and just south of Yennedon post office. This is about 7 miles above the mouth of the North Lillooet, and 7 miles below Lillooet lake.

The gauge is a chain gauge located near the middle of the bridge on the downstream side—plumber's chain with a plumbbob 24.3 feet long over all. There is also a vertical staff gauge 8 feet long attached to the cribwork of the bridge. Both gauges are referred to the same datum, and three bench-marks are established.

Discharge Measurements of South Lillooet River, 8 miles from mouth, 1911–12–13.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
1911.							
Oct. 26......	C. G. C. & K. H. S..........	1,057	100	113	2·0	1·18	226
Dec. 13......	K. H. Smith..................	1,057	120	316	4·3	2·80	1,360
1912.							
July 4......	C. G. Cline..................	1,046	105	151	2·4	1·50	361
Aug. 17......	do	1,046	125	288	3·5	2·70	1,010
Sept. 10......	do	1,046	115	234	3·3	2·00	767
Nov. 13......	do	1,046	125	608	8·1	4·60	4,950
1913.							
May 22......	C. G. Cline..................	1,044	125	266	4·4	2·45	1,180
July 10......	K. G. C. & C. G. C..........	1,055	125	296	3·8	2·4	1,120

Monthly Discharge of South Lillooet River, near Mouth for 1913.

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
January	1,420	220	593	5·93	6·84	36,500
February	5,920	140	1,180	11·80	12·29	65,500
March	2,830	160	693	6·93	7·99	42,600
April	1,420	320	872	8·72	9·73	51,900
May	2,170	440	1,238	12·38	14·30	76,200
June	1,640	840	1,095	10·95	12·18	64,900
July	1,310	320	757	7·57	8·72	46,500
August	750	140	303	3·03	3·49	18,600
September	2,170	120	526	5·26	5·87	31,300
October	4,410	120	1,021	10·21	11·76	63,000
November	5,920	580	2,038	20·38	22·74	121,000
December	1,880	320	900	9·00	10·38	55,300
The year	5,920	120	934	9·34	126·29	673,300

Note.—Accuracy "A", "B" and "D".

Daily Gauge Heights and Discharges of South Lillooet River near mouth for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	2·7	1,420	1·6	440	1·1	190	1·6	440	1·9	660	2·2	930
2	2·5	1,210	1·6	440	1·1	190	1·5	370	1·8	580	2·8	1,530
3	2·4	1,110	1·6	440	1·0	160	1·5	370	1·7	510	2·9	1,640
4	2·3	1,020	1·5	370	1·0	160	1·4	320	1·7	510	2·9	1,640
5	2·3	1,020	1·5	370	1·2	220	2·0	750	1·6	440	2·8	1,530
6	2·4	1,110	1·5	370	1·4	320	1·9	660	1·6	440	2·4	1,110
7	2·1	840	1·3	270	1·5	370	1·8	580	1·7	510	2·4	1,110
8	1·8	580	1·3	270	1·7	510	1·7	510	2·1	840	2·4	1,110
9	1·7	510	1·2	220	1·7	510	1·7	510	2·3	1,020	2·4	1,110
10	1·7	510	1·1	190	1·7	510	1·0	440	2·8	1,530	2·2	930
11	1·6	440	1·0	160	1·7	510	1·9	660	2·9	1,640	2·1	840
12	1·5	370	1·0	160	1·8	580	2·1	840	3·1	1,880	2·1	840
13	1·4	320	0·9	140	1·6	440	2·3	1,020	2·9	1,640	2·2	930
14	1·6	440	1·2	220	1·6	440	2·4	1,110	3·0	1,760	2·2	930
15	1·7	510	3·5	2,470	1·9	660	2·2	930	3·2	2,020	2·4	1,110
16	1·6	440	4·5	6,660	2·5	1,210	2·1	840	3·3	2,170	2·4	1,110
17	1·5	370	5·0	5,920	3·1	1,880	2·1	840	2·9	1,640	2·2	930
18	1·4	320	4·7	5,170	3·7	2,830	1·9	660	3·0	1,760	2·2	930
19	1·4	320	3·6	2,640	3·3	2,170	2·2	930	2·7	1,420	2·3	1,020
20	1·3	270	3·2	2,020	3·2	2,020	2·5	1,210	2·5	1,210	2·4	1,110
21	1·3	270	3·0	1,760	2·1	340	2·7	1,420	2·4	1,110	2·6	1,310
22	1·4	320	2·5	1,210	1·9	660	2·7	1,420	2·4	1,110	2·6	1,310
23	1·2	220	2·3	1,020	1·7	510	2·6	1,310	2·4	1,110	2·3	1,020
24	1·5	370	1·9	660	1·6	440	2·4	1,110	2·5	1,210	2·2	930
25	1·7	510	1·7	510	1·6	440	2·5	1,210	2·5	1,210	2·2	930
26	1·8	580	1·5	370	1·3	270	2·6	1,310	2·9	1,640	2·1	840
27	1·9	660	1·3	270	1·2	220	2·6	1,310	2·9	1.640	2·1	840
28	1·9	660	1·3	270	1·5	370	2·5	1,210	2·8	1,530	2·2	930
29	1·8	580	....	....	2·0	750	2·3	1,020	2·6	1,310	2·2	930
30	1·8	580	....	....	1·9	660	2·1	840	2·5	1,210	2·7	1,420
31	1·7	510	....	....	1·7	510	....	....	2·4	1,110	....	....

DAILY GAUGE HEIGHTS AND DISCHARGES of South Lillooet River near mouth for 1913—*Concluded.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	2·6	1,310	1·4	320	1·0	160	1·0	160	1·8	580	3·1	1,880
2	2·6	1,310	1·4	320	1·1	190	1·0	160	1·8	580	3·0	1,760
3	2·5	1,210	1·5	370	1·2	220	0·9	140	1·8	580	2·7	1,420
4	2·4	1,110	1·5	370	1·8	580	0·9	140	1·8	580	2·5	1,210
5	2·4	1,110	1·2	220	3·3	2,170	0·9	140	2·4	1,110	2·3	1,020
6	2·4	1,110	1·0	160	3·0	1,760	0·8	120	2·9	1,640	2·2	930
7	2·3	1,020	1·0	160	2·8	1,530	0·9	140	2·9	1,640	2·2	930
8	2·3	1,020	1·0	160	2·5	1,210	0·9	140	2·7	1,420	2·1	840
9	2·2	930	0·9	140	2·5	1,210	1·0	160	2·5	1,210	2·0	750
10	2·0	750	0·9	140	2·1	840	1·0	160	2·6	1,310	1·8	580
11	2·4	1,110	0·9	140	2·0	750	1·6	440	2·4	1,110	1·9	660
12	2·3	1,020	1·0	160	1·8	580	2·5	1,210	2·2	930	2·0	750
13	2·3	1,020	1·0	160	1·8	580	2·4	1,110	2·0	750	2·0	750
14	2·2	930	1·0	160	1·9	660	....	2,760	1·9	660	2·1	840
15	2·2	930	1·1	190	1·7	510	4·4	4,410	1·7	510	2·8	1,530
16	2·2	930	1·1	190	1·5	370	3·9	3,230	4·5	4,660	2·0	1,640
17	2·0	750	1·4	320	1·5	370	3·5	2,470	3·8	3,020	2·7	1,420
18	1·8	580	1·9	660	1·4	320	3·1	1,880	3·5	2,470	2·6	1,310
19	1·7	510	2·0	750	1·2	220	2·9	1,640	3·0	1,760	2·3	1,020
20	1·7	510	1·8	580	1·0	160	2·65	1,365	2·7	1,420	2·1	840
21	1·5	370	1·8	580	1·0	160	2·5	1,210	2·6	1,310	2·0	750
22	1·5	370	1·7	510	0·9	140	2·4	1,110	2·5	1,210	1·9	660
23	1·7	510	1·9	660	0·9	140	2·3	1,020	2·5	1,210	1·7	510
24	1·8	580	1·6	440	0·9	140	2·35	975	5·0	5,920	1·6	440
25	1·6	440	1·4	320	0·9	140	2·3	1,020	4·8	5,420	1·5	370
26	1·5	370	1·3	270	0·9	140	2·2	930	4·5	4,650	1·4	320
27	1·4	320	1·2	220	0·8	120	2·1	840	4·4	4,410	1·6	440
28	1·4	320	1·2	220	0·8	120	2·0	750	4·3	4,170	1·8	580
29	1·5	370	1·1	190	0·9	140	1·9	660	3·8	3,020	1·8	580
30	1·5	370	1·0	160	1·0	160	1·8	580	3·1	1,880	1·8	580
31	1·4	320	1·0	160	....	....	1·8	580	....	....	1·8	580

STAVE RIVER.

Stave river rises in Stave lake at an elevation of about 225 feet, and flowing southerly, discharges into Fraser river at Ruskin, at an elevation of 20 feet. It is part of Fraser drainage. Cascade creek flows into Stave river from the east near Stave falls, and McConnell and Cypress creeks flow into Stave Lake also from the east. Glacier and Clearwater creeks enter Stave lake from the west, and the Upper Stave river flows in from the north. This latter stream has not been thoroughly explored, and is visited only by trappers and timber cruisers. It is outside of the Railway Belt, and there are no reliable maps. It is impossible to determine the drainage area accurately, but the engineers of the Western Canada Power Company estimate it at 450 square miles.

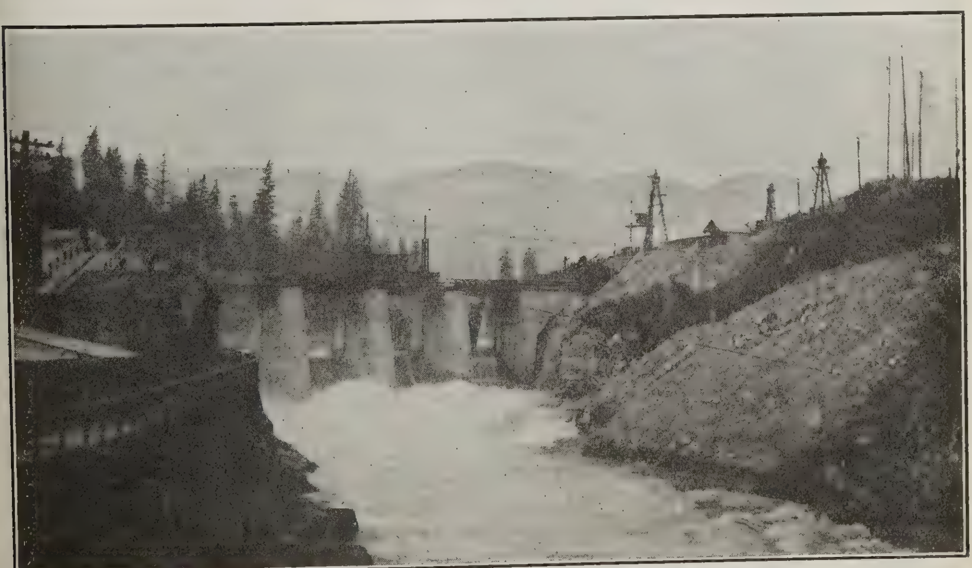
The waters of Stave river are being used to develop hydro-electric power which is used in Vancouver, New Westminster, and the surrounding country as far east as Mission.

Precipitation records have been kept at Stave falls by the Western Canada Power Company since October, 1909, and show a mean of about 80 inches. This is probably much less than the average over the whole watershed.

Below the lake the winter conditions are not severe. There are heavy rains at different times of the year, but very little snow or frost, and the river does not freeze over. In the higher altitudes the snowfall is heavy, and there is snow on the mountain peaks practically all summer.

There are a number of glaciers in the watershed. The spring freshets come about May or June, and the run-off is kept large nearly all summer by the melting of the snow on the mountains and glaciers. In the autumn, in October or November, there is generally another flood, caused by the warm autumn rains falling on what is left of the snow. This freshet does not last as long as that in the spring, but is generally more severe. Sometimes also a fall of rain and a few days warm weather in December or January will cause another rise, or winter freshet, of short duration. The low-water periods occur in the autumn near the latter part of August or in September, and in the winter during January, February and March. These statements are, however, only general, and do not always hold true.

Regular gaugings of Stave river have been made by the power company since May, 1905. The first gauge was above the site of the dam, and was flooded out in April, 1910. Since September of that year, a gauging station below the dam has been used. Here there is a good permanent gauge, securely fastened to a heavy timber crib, loaded with rocks, and the gauge has been referred to the regular system of levels used for the construction work. Meter measurements were made from a car suspended from a steel cable, which was stretched across the stream at the gauge. A good rating curve was obtained, particularly at the low and medium stages. Check measurements of discharge were made by the engineers of the Hydrographic Survey. These agree with the power company's rating curve to within 5 per cent. Since the beginning of 1912, stoplogs have been in place in the main dam, and the water of Stave lake has been kept at an artificial level. Hence the discharges of Stave river as recorded by the power company are not the natural flow of the river.



Stave River—Western Canada Power Company. Weir Measurements through Sluice Dam.

Stave lake lies mainly in townships 4 and 5, range 3, west of the 7th meridian. It was originally 9 miles long in a north-and-south direction, and about 1½ miles wide. The east and west shores are almost precipitous, but at the head and foot of the lake there are low-lying areas which are flooded at high water. The lake now makes a good storage reservoir.

Seven miles south of the lake there is a fall in the river, and, including the rapids in the immediate vicinity, there is a total drop of 80 feet. A dam 55 feet high has been constructed, and this is sufficient to drown out the rapids, and to raise the level of the lake about 20 feet. Consequently the reservoir extends from the dam to the upper end of the lake, including the low-lying lands above mentioned. The reservoir is therefore about 16 miles long, and has an area of about 18 square miles.

The total available head is 120 feet, or at the low level of the lake, 100 feet, giving an average head of 110 feet. By means of the storage, a mean flow of at least 3,000 c.f.s. can be obtained. The present power development should produce some 28,000 horse-power continuously, and, under usual operating conditions, a peak load of about 45,000 horse-power.

Below Stave falls, the river continues its course over a series of rapids for a distance of 4 miles, finally debouching through a narrow granite gorge into a tide water basin, where it joins the Fraser river. By the construction of a dam in this gorge a head of 120 feet could be obtained, and the water as it comes from the upper plant could be used to develop a similar quantity of power. In this way the total capacity of Stave river could be used to its best advantage.

The upper Lillooet lake is only about a mile from Stave lake, and is 100 feet higher. A short tunnel would permit the diversion of water into Stave lake, where it would augment the flow available for the Western Canada Power Company. The 100-foot fall from Lillooet lake to Stave lake could probably be utilized also by a plant built near Stave lake below the end of the tunnel.

The present installation at Stave falls includes the dams and spillways necessary to regulate and control the water. The intake and power-house have been placed in an old channel of the river, and this channel has been deepened below the power house, to serve as the tail-race. Machinery has been installed for the development of 26,000 horse-power, consisting of two 13,000 horse-power turbines directly connected to 7,500 kilowatt alternating current generators with the necessary exciters, transformers, switches, etc., and 35 miles of double transmission line (60,000 volts) to the receiving station at Vancouver. Provision has been made for the installation of two more units of 13,000 horse-power each, and it is understood that the company has already ordered some of the additional machinery and equipment.

STAVE RIVER

Location.—Near plant of Western Canada Power Company at Stave falls in section 3, township 4, range 3, west of 7th meridien.

Records Available.—April 19 to December 21, 1901; May 3 to December 31, 1905; January 1 to December 31, 1906; January 1 to December 31, 1907; January 1 to December 31, 1908; January 1 to December 31, 1909; January 1 to April 30, 1910; September 27 to December 31, 1910; January 2 to December 31, 1911; January 1 to December 31, 1912; January 1 to September 30, 1913.

Winter Conditions.—Open water all season.

Gauge.—Vertical staff gauge fastened to rock-filled crib; daily readings; washed out in October 1913.

Channel.—Permanent rocky channel, water swift at higher stages.

Discharge Measurements.—Large number of meter measurements taken from permanent cable station by engineers of the Western Canada Power Company. Three check measurements taken by the engineers of the British Columbia Hydrographic Survey show close agreement. Channel changed in October freshet.

Accuracy.—Good.

Monthly Discharge of Stave River at Stave Falls for 1913.

Month.	Discharge in Second-Feet. Maximum.	Minimum.	Mean.	Run-Off. Total in acre-feet.
January	3,710	710	1,533	94,100
February	18,400	780	2,999	166,600
March	8,500	810	2,319	142,600
April	7,210	1,800	3,690	219,600
May	11,100	2,190	5,830	358,500
June	10,000	5,650	7,467	443,300
July	11,400	3,810	6,675	410,500
August	8,120	2,440	3,650	224,400
September	31,700	1,760	5,157	307,000

Daily Gauge Heights and Discharges of Stave River near Stave Falls for 1913.

Day.	January. Gauge Height.	January. Discharge.	February. Gauge Height.	February. Discharge.	March. Gauge Height.	March. Discharge.	April. Gauge Height.	April. Discharge.	May. Gauge Height.	May. Discharge.	June. Gauge Height.	June. Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feef.	Sec.-ft.	Feet.	Sec.-ft.
1	....	3,000	....	1,270	....	810	....	2,150	....	2,190	....	8,830
2	....	2,610	....	1,480	....	1,270	....	1,800	....	2,400	....	9,670
3	....	2,290	....	1,410	....	2,010	....	2,010	....	2,650	....	10,000
4	....	1,830	....	1,200	....	1,550	....	2,150	....	2,820	....	9,700
5	....	1,380	....	990	....	920	....	3,850	....	2,190	....	7,770
6	....	1,270	....	920	....	2,580	....	3,320	....	2,720	....	6,710
7	....	1,830	....	880	....	2,720	....	2,650	....	3,630	....	6,960
8	....	1,520	....	850	....	2,440	....	2,300	....	5,080	....	7,950
9	....	1,230	....	810	....	2,400	....	2,120	....	6,780	....	6,460
10	....	1,230	....	780	....	2,400	....	3,530	....	7,560	....	5,830
11	....	1,130	....	850	....	2,010	....	4,700	....	7,450	....	5,860
12	....	810	....	880	....	2,330	....	5,120	....	7,100	....	7,000
13	....	1,130	....	990	....	2,120	....	4,480	....	7,300	....	8,050
14	....	1,730	....	2,750	....	1,690	....	4,130	....	6,890	....	7,000
15	....	920	....	10,100	....	1,480	....	3,880	....	6,850	....	8,410
16	....	1,230	....	18,400	....	4,100	....	2,650	....	6,140	....	7,180
17	....	1,060	....	15,400	....	8,500	....	2,610	....	4,580	....	5,900
18	......	740	....	5,400	....	4,420	....	4,100	....	5,400	....	5,650
19	....	710	....	3,990	....	2,820	....	5,930	....	6,570	....	8,330
20	....	850	....	3,880	....	1,940	....	4,980	....	5,650	....	8,760
21	....	1,230	....	2,660	....	1,550	....	7,210	....	4,420	....	7,180
22	....	710	....	2,120	....	1,340	....	5,300	....	5,650	....	7,680
23	....	1,410	....	1,520	....	1,980	....	3,960	....	6,360	....	6,630
24	....	2,440	....	1,270	....	1,550	....	3,530	....	6,710	....	5,970
25	....	3,710	....	1,090	....	1,340	....	3,810	....	7,070	....	6,460
26	....	2,290	....	920	....	1,230	....	5,470	....	11,100	....	6,570
27	....	1,760	....	950	....	2,010	....	4,940	....	9,180	....	6,280
28	....	1,590	....	810	....	1,980	....	3,530	....	7,800	....	8,200
29	....	1,410	....	....	....	3,460	....	2,470	....	7,000	....	7,170
30	....	1,310	....	....	....	2,580	....	2,120	....	6,320	....	9,850
31	....	1,160	....	....	....	2,360	....	....	....	7,530	....	....

DAILY GAUGE HEIGHTS AND DISCHARGES of Stave River near Stave Falls for 1913.—*Concluded.*

Date.	July.		August.		September.	
	Gauge Height Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	11,400	....	4,620	....	2,220
2	....	7,950	....	4,480	....	2,290
3	....	6,880	....	4,200	....	15.460
4	....	6,430	....	3,880	....	31,700
5	....	6,780	....	3,530	....	15,950
6	....	7,800	....	3,280	....	9,750
7	....	9,610	....	3,180	....	6,070
8	....	6,390	....	3,460	....	4,840
9	....	6,530	....	3,500	....	6,430
10	....	8,090	....	3,390	....	5,400
11	....	6,740	....	3,350	....	4,310
12	....	6,610	....	4,420	....	3,350
13	....	5,410	....	3,430	....	2,890
14	....	5,010	....	3,640	....	3,070
15	....	4,200	....	3,880	....	2.820
16	....	4,480	....	4,060	....	2,580
17	....	4,620	....	4,660	....	2,470
18	....	5,300	....	8,120	....	2,610
19	....	6,320	....	5,360	....	2,930
20	....	6,920	....	4,020	....	2,580
21	....	7,030	....	3,320	....	2,650
22	....	6,990	....	2,860	....	2,820
23	....	6,990	....	3,180	....	2,650
24	....	7,060	....	3,040	....	2,290
25	....	7,530	....	2,860	....	1,940
26	....	10,800	....	2,750	....	1.760
27	....	9,820	....	2,680	....	2,050
28	....	5,300	....	2,650	....	3,740
29	....	3,810	....	2,510	....	2,650
30	....	4,310	....	2,470	....	2,440
31	....	3,810	....	2,440	....	....

YOUNG CREEK

Location.—At mouth, in section 10, township 7, range 7, west of 7th meridian.

Records Available.—Continuous since October 20, 1912.

Winter Conditions.—Very heavy snowfall but very little ice in stream; practically open water conditions all season.

Gauge.—Vertical staff gauge, readings once or twice a week.

Channel.—Permanent rocky channel.

Discharge Measurements.—One measurement in 1912 and five in 1913 show fair agreement and cover all stages except the larger freshets.

Accuracy.—Infrequency of gauge readings will tend to impair accuracy of results.

YOUNG CREEK.

Young creek has its source in Young lake at an elevation of 2,200 feet, and discharges into Brandt creek about 2 miles from its mouth, at an elevation of 1,800 feet. It is part of Burrard Inlet drainage.

The rainfall in the Young creek watershed is probably between 120 and 150 inches. There are several feet of snow in the winter, but comparatively little ice, and open-water conditions prevail at the gauging station.

The Westminster Power Company proposes to include Young creek in its high-head development. The latest plan is to divert the water from Young lake through a pipeline to Norton lake, which is to be the main equalizing reservoir. From Young lake the main pipeline will be carried down the hill to the power-house situated near the mouth of Brandt creek. A dam constructed at the outlet of Young lake will provide for considerable storage.

A gauging station has been established by this survey at the mouth of Young creek. The gauge readings so far have been rather irregular. A trail has now been cut from Norton lake to Young lake and it may be found better to discontinue the station at the mouth of Young creek, and establish a new one at Young lake. The erection of a cabin at Norton lake as headquarters for the gauge readers will render this plan more feasible.

DISCHARGE MEASUREMENTS of Young Creek at Mouth 1912 and 1913.

Date.	Hydrographer.	Meter No.	Width	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq.-ft.	Ft. per sec.	Feet.	Sec.-ft.
1912							
Oct. 20...	C. G. Cline....................	1,046	10·0	10·8	1·06	2·00	11·41
1913							
June 3......	H. C. Hughes.................	1,673	18·0	21·8	2·46	1·80	53·61
June 10......	do	1,673	14·0	15·4	1·95	1·50	30·02
June 18......	do	1,673	13·0	16·4	2·26	1·65	37·0
July 30......	do	1,673	11·0	7·75	0·80	1·03	6·19
Sept. 18......	F. MacLachlan................	1,673	10·0	10·8	0·80	1·01	8·61

NOTE.—[1]Old Gauge No. 1 washed out November, 1912.
[2]Gauge No. 2 set December 7, 1912.

Monthly Discharge of Young Creek at Mouth for 1913.

Month.	Discharge in Second-Feet.			Run-Off.
	Maximum.	Minimum.	Mean.	Total in acre-feet.
January	11·5	7·0	8·2	504
February	28·0	8·5	16·6	992
March	25·0	11·5	19·1	1,170
April	53·0	11·5	30·1	1,790
May	140·0	15·0	51·0	3,140
June	53·0	28·0	36·4	2,170
July	35·0	8·0	19·9	1,220
August	13·0	4·0	6·9	424
September	13·0	6·0	8·9	530
October	130·0	5·8	20·6	1,260
November	28·0	10·0	14·0	833
December	13·0	6·0	10·2	627
The year	140·0	4·0	20·2	14,600

Note.—Accuracy "B" and "C".

Monthly Discharge of Young Creek at Mouth for 1912.

Month.	Discharge in Secon -Feet.			Run-Off.
	Maximun.	Minimum.	Mean.	Total in acre-feet.
November	20	11	16·1	958
December	11·5	8	8·87	545

Note.—Accuracy "C."

Daily Gauge Heights and Discharges of Young Creek near Mouth for 1912.

Day.	October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1				16·0		10·0
2				17·0		10·0
3				17·0		9·0
4				18·0		9·0
5				18·0	Gauge	9·0
6				19·0	No. 2.	8·5
7				19·0	1·05	8·5
8			2·2	20·0		9·5
9				20·0		10·5
10				19·0	1·15	11·5
11				19·0		11·0
12				19·0		11·0
13				18·0		9·0
14				18·0	1·15	8·5
15				18·0		8·5
16				17·0		8·5
17				17·0	8·05	
18	Gauge			16·0		8·5
19	No. 1.			16·0		8·5
20	2·0	11·4		15·0		8·5
21		11·5		15·0	1·05	8·5
22		12·0		14·0		8·5
23		12·0		14·0		8·5
24		13·0		13·0	1·05	8·5
25		13·0		13·0		8·5
26		14·0		12·0		8·0
27		14·0		12·0		8·0
28		15·0		12·0		8·0
29		15·0		11·0		8·0
30		16·0		11·0		8·0
31		16·0				8·0

DAILY GAUGE HEIGHTS AND DISCHARGES of Young Creek at Mouth for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	8·0	....	11	....	25	....	11·5	1·25	15	....	45
2	....	7·5	....	11	....	25	1·15	11·5	....	15	....	50
3	....	7·5	....	10	....	25	....	11·5	....	16	1·8	53
4	....	7·5	....	10	....	25	....	12	....	16	....	50
5	....	7 5	1·1	10	....	25	....	12	....	17	....	46
6	....	7·5	....	10	....	25	....	13	1·3	17	....	43
7	....	7·5	1·1	10	1·45	25	....	13	....	50	1·65	40
8	....	7·0	....	10	....	25	1·2	13	....	80	....	35
9	....	7·0	....	10	....	24	....	19	....	110	....	30
10	....	7·0	....	9	....	23	....	24	2·7	140	1·5	28
11	1·0	7·0	....	9·0	1·4	22	....	29	....	120	....	28
12	....	7·0	....	8·5	....	21	....	34	....	100	....	28
13	....	7·0	1·05	8·5	....	19	....	39	....	80	....	28
14	....	7·0	....	10·0	1·3	17	1·7	44	....	62	1·5	28
15	....	7·0	....	13·0	....	18	....	46	1·7	44	....	31
16	....	7·0	....	16·0	....	19	....	48	....	44	....	34
17	....	7·0	....	19·0	....	20	....	51	....	44	....	37
18	1·8	7·0	....	22	....	21	1·8	53	....	44	1·65	40
19	....	7·5	....	25	1·4	22	....	50	1·7	44	....	40
20	....	7·5	1·5	28	....	20		48	....	44	....	40
21	....	8·0	....	28	....	19	....	46	....	44	....	40
22	....	8·0	....	27	1·3	17	1·7	44	....	44	....	40
23	....	8·5	....	26	....	16	....	40	1·7	44	1·65	40
24	....	9·0	....	25	....	14	....	37	....	44	....	34
25	....	9·5	1·45	25	....	12	....	34	....	45	1·5	28
26	....	10·0	....	25	1·15	11·5	....	30	....	46	....	30
27	....	10·5	....	25	....	11·5	....	27	....	47	....	31
28	....	11·0	....	25	....	11·5	....	24	1·75	48	1·55	32
29	....	11·0	....	....	....	11·5	....	21	....	42	....	32
30	1·15	11·5	....	....	....	11·5	....	18	1·6	35	....	31
31	....	11·5	....	....	....	11·5	....	....	....	40	....	....

DAILY GAUGE HEIGHTS AND DISCHARGES of Young Creek at Mouth for 1913—*Concluded.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	30	....	8·5	....	6·0	1·01	7·3	....	10	....	12
2	....	30	1·05	8·5	....	7·0	....	7·3	....	13	....	13
3	....	29	....	8·0	....	8·0	....	7·0	....	15	....	13
4	....	28	....	7·0	....	10·0	....	7·0	....	17	....	13
5	1·5	28	0·95	6·0	....	11·0	....	7·0	....	20	1·2	13
6	....	32	....	6·0	....	12·0	....	7·0	....	23	....	13
7	1·6	35	....	6·0	1·2	13·0	....	7·0		....		
8	1·4	22	....	6·0	....	13·0	....	7·0	1·5	28	....	12
9	....	22	0·95	6·0	....	13·0	1·0	7·0	....	24	....	12
10	....	22	....	6·0	....	13·0	....	45·0		20	.....	12
11	....	22	....	6·0	1·2	13·0	....	90·0		....	....	11
12	1·4	22	....	6·0	....	11·0	2·6	130·0	....	13	....	11
13	....	22	....	7·0	....	9·0	1·8	53·0	1·1	10	....	11
14	....	21	....	7·0	1·0	7·0	....	40·0	....	10	....	11
15	....	21	....	7·0	....	7·0	....	30·0		10	....	11
16	....	21	1·0	7·0	....	7·1	1·25	15·0		....	....	10
17	....	21	....	9·0	....	7·2	....	15·0	....	10	....	10
18	....	20	....	11·0	1·01	7·3	....	15·0	....	10	....	10
19	1·35	20	1·2	13·0	....	7·2	....	14·0	....	10	1·1	10
20	....	20	....	11·0	....	7·1	....	14·0	....	10	....	10
21	....	18	......	9·0	....	7·0	....	14·0	....	11	....	10
22	....	16	1·0	7·0	....	6·9	....	13·0	....	11	....	10
23	1·25	15	....	7·0	0·99	6·8	....	13·0	....	11	....	9
24	....	14	....	6·0	....	7·0	1·2	13·0	....	11	....	9
25	....	12	....	5·0	....	7·0	....	18·0	....	11	....	8
26	1·1	10	0·9	5·0	....	8·0	....	10·0	....	12	....	7
27	....	10	0·9	5·0	....	8·0	....	9·0	....	12	....	7
28	....	9	....	5·0	....	9·0	....	8·0	....	12	....	6
29	....	8	....	4·0	....	10·0	....	7·0	....	12	....	6
30	1·03	8	0·85	4·0	1·1	10·0	0·94	5·8	....	12	0·95	6
31	....	8	....	5·0	....	....	....	8·0	....	....	....	6

MISCELLANEOUS METERING STATIONS.

BELKNAP CREEK BELOW ANN LAKE.

Location.—Section 12, township 7, range 7, west of 7th meridian.

Records Available.—Three meter measurements only.

Winter Conditions.—Very heavy snowfall, but very little ice on the stream. Open water conditions all year.

Gauge.—Gauge painted on big boulder in the stream—no gauge readings.

Channel.—Bed of stream covered with rocks and boulders, giving uneven bottom but good control.

Discharge Measurements.—Three measurements in 1913.

Accuracy.—The three measurements give accurately the discharge on the days they were taken. No gauge readings.

Discharge Measurements of Belknap Creek at Anne Lake, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
1913							
June 24	H. C. Hughes	1673	27	76·5	1·76	2·52	135
Aug. 1	H. C. Hughes	1673	32	91·0	0·91	2·08	82·5
Sept. 19	F. MacLachlan	1673	30	59·5	0·50	1·20	29·8

BRIDGE RIVER.

Location.—Near Seton lake, and about 30 miles from the mouth of Bridge river.

Records Available.—One meter measurement. Gauge readings taken regularly since June, 1913, will be available when meter measurements have been made.

Winter Conditions.—Open-water conditions practically all year.

Gauge.—Vertical staff gauge; readings taken twice daily since June, 1913.

Channel.—Sandy, possibility of shifting.

Discharge Measurements.—One measurement.

Accuracy.—Only one meter measurement taken during 1913, but a good set taken during 1914 should give accurate discharge data from the gauge records which have been kept.

BRIDGE RIVER.

Bridge river has its source in the mountains northwest of Lillooet, at an elevation of from 8,000 to 10,000 feet. The stream discharges into the Fraser river 4 miles north of Lillooet at an elevation of 700 feet. It is part of the Fraser drainage.

The south fork enters from the south; and from the north, the north fork, Tyaughton creek and Gun creek. The 1912 provincial map (scale 17.75 miles to 1 inch) shows a drainage area of 2,400 square miles for the whole stream. About 1,900 miles of this is above the gauging station, which is near the site of the intake for the proposed hydro-electric plant.

Probably a small amount of water from the river is used at the various mines. There is a good location for a hydro-electric power development on this stream, as explained below. Water from some of the smaller tributaries is used for irrigation.

The precipitation during the eleven months ending April 30, 1914, was 22 inches. There is snow in the winter, but the cold is not steady and rain is frequent during the winter months. Ice forms in the upper part of the watershed, but the stream is open practically all the year at the gauging station.

The station was established June 13, 1913, by one of the engineers of the Provincial Water Rights Branch, and was taken over by the British Columbia Hydrographic Survey in October, 1913. Gauge readings have been continuous since June 13, 1913.

A number of branches combine about 60 miles northwest of Lillooet to form Bridge river proper. The stream flows through a comparatively narrow valley surrounded by high hills and mountains. About 20 miles from Lillooet it enters a rocky canyon. A few miles above this canyon the stream flows within 5 miles of Seton lake. The elevation of the stream at this point is about 2,800 feet, while the elevation of Seton lake is only 800 feet. This gives a difference in elevation

of some 2,000 feet. The ridge separating the two rises to an altitude of something like 4,000 feet. A wagon road has been built from Mission, at Seton lake, over this ridge to give an entrance into the Bridge River valley. This route was selected in preference to that of the old pack trail which follows up the river from its mouth.

Until the last year or two, comparatively little was heard of the Bridge River country. Some discoveries in mineral, however, created a mild mining boom. A few mines were opened, particularly on Gun creek, and a road was built over the divide, from Seton lake, to replace part of the old pack trail. Some of these mines are being worked at present.

A few ranches have been taken up in the valley above the canyon. Most of these are not very extensive as yet, and probably do not furnish what supplies are necessary for the mines. There is some good land which has not been taken up, but the farming industry will probably never be of very great importance. Near the mouth of the river there are some good benches which produce good crops when irrigated.

On account of the proximity of Bridge river to Seton lake, and the great difference in altitude, there is a splendid chance to develop a large amount of water-power. By driving a tunnel through the intervening ridge, water could be diverted from Bridge river and conveyed to a point on the hillside above Seton lake, whence steel penstocks could be laid to a power-house situated on the lake. Such an installation could make use of the whole minimum flow of Bridge river at a head of about 2,000 feet. If storage could be obtained on Bridge river, the available flow could be increased. The minimum flow of the stream has not been determined as yet, but the measurements given below show that this stream has great power possibilities. For instance, a flow of 1,000 second-feet at a 2,000-foot head would permit a development of more than 150,000 horse-power. The length of the tunnel required, however, will necessitate a large initial development, and before this could be undertaken a market for the power should be assured. The presence of the Pacific Great Eastern railway, which is being constructed along Seton lake, while providing good transportation, introduces certain complications. The diversion of so much water into Seton lake will call for some improvements in Seton creek, which drains the lake, in order to protect the riparian owners. The natural flow of Seton creek is being studied at present by the engineers of this survey.

The gauging station on Bridge river is established at the bridge where the wagon road crosses the river, about 8 miles from Mission and 27 miles from the mouth of Bridge river. There is a staff gauge securely fastened to the timber abutment of the bridge and referenced to three bench-marks. The measurements are made from the upstream side of the bridge, with the meter and weight suspended on a cable. The gauge readings are taken twice a day. A rain gauge is also in use to determine the precipitation.

DISCHARGE MEASUREMENTS of Bridge River, near Seton Lake, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
1913							
Oct. 7......	C. G. Cline and H. J. E. Keys	1057	159	1,050	1·8	2·38	1,890

NOTE—Station established.

CAPILANO CREEK.

Location.—Just above the Vancouver intake, about 6 miles from the mouth of the creek.

Records Available.—Two meter measurements. Gauge readings since November, 1913, will be available as soon as sufficient meter measurements have been made.

Winter Conditions.—Open water all season.

Gauge.—Vertical staff gauge, readings twice daily.

Channel.—Rocky bed, water swift at high water.

Discharge Measurements.—One meter measurement in 1909 and one in 1913.

Accuracy.—When a good set of meter measurements have been taken and combined with the gauge readings, the results should be quite accurate.

CAPILANO CREEK.

Capilano creek rises in the mountains east of Howe sound, at an elevation of about 2,000 feet, and discharges into Burrard inlet, north of North Vancouver, at sea-level. It has a number of unnamed creeks tributary to it. The drainage area above the Vancouver intake is estimated by the engineers of the Provincial Water Rights Branch at 55 square miles. The stream provides a water supply for the city of Vancouver and the municipality of Point Grey. The precipitation is probably considerably more than 100 inches per annum.

Capilano creek is a swift mountain stream with clear pure water flowing from a well-timbered mountainous watershed. There is no settlement above the intake, and hence no chance for the pollution of the water. On the higher altitudes, and as low as 3,000 feet above sea-level, snow remains in large quantities throughout the whole year. This snow storage plays an important part in regulating the flow of the stream, for the snow melts in the summer and provides a good supply of water at a time when the stream would otherwise be low.

The waterworks intake is some 6 miles from the mouth of the creek. There is a substantial concrete intake fitted with screens, control gates, etc. The water is conveyed in steel pipes down the valley. The pipeline crosses Burrard inlet at the First Narrows and is laid through Stanley park to connect with the city mains. The municipality of Point Grey is to obtain its water supply in a similar manner.

The Capilano valley is quite a resort for tourists, mountain climbers, campers and holiday and outing parties generally. There are two hotels, besides a number of refreshment booths in the summer. One of the North Vancouver car lines runs to the creek, and there are good automobile roads. The natural beauties of the stream and its canyon are a great attraction, and in fine weather large numbers of people visit the various points of interest.

A considerable amount of cedar is cut in the Capilano valley. A lumber chute, several miles in length, has been built, and in this the cedar shingle bolts are sluiced down to Burrard inlet.

A gauging station was established by the British Columbia Hydrographic Survey in November, 1913, to measure the flow of the stream at the waterworks intake. The gauge readings are being taken twice a day. During 1914, sufficient meter measurements will be made to develop a rating curve and so render the gauge readings available. One measurement was made in 1913, giving a flow of approximately 400 cubic feet per second, as shown below

DISCHARGE MEASUREMENTS of Capilano Creek above city intakes 1909-13.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Gauge Height.	Discharge.
1909			Feet.	Sq. ft.	Feet.	Sec.-ft.
Aug. 4......	M. Cleveland..........................	....	....	....	....	318
1913						
Nov. 6......	H. J. E. Keys..........................	....	58	196	0·90	400

CHEAKAMUS RIVER.

Location.—Near mouth of river, and 10 miles north of Squamish (Newport).

Records Available.—One meter measurement only. Regular gauge readings commencing November 29, 1913, will be available when sufficient meter measurements have been made.

Winter Conditions.—Open water all season.

Gauge.—Chain gauge from highway bridge, readings daily.

Channel.—Rocky and permanent.

Discharge Measurements.—One measurement in 1913.

Accuracy.—A good set of meter measurements should give good results with the gauge readings which have been taken.

CHEAKAMUS RIVER.

Cheakamus river rises 40 miles north of Howe sound, near the head of Green river, at an elevation of some 2,500 feet. It discharges into the Squamish river, near Howe sound, at an elevation of about 100 feet, and forms part of the Howe sound drainage. The drainage area of the Cheakamus river, as measured from the provincial map of 1912 (scale 17.75 miles to 1 inch) is about 250 square miles.

The precipitation in the Cheakamus valley is fairly heavy. There is snow in the winter, particularly in the higher altitudes. The small lakes in the headwaters freeze in the winter, but the stream itself remains pretty well open on account of the swiftness of the water.

The route of the Pacific Great Eastern railway follows the Cheakamus river for some 25 miles. For part of this distance the river flows through a rocky canyon, which makes the construction of railroads and trails very difficult and expensive. Above the canyon the valley broadens out, but there is still a great deal of rock in evidence. There is considerable timber in the watershed, but there is not much good farming land.

Between Summit lake and Squamish river, a distance of some 25 miles, there is a total fall of about 1,900 feet. Much of this occurs in the 5 or 6 miles of canyon. The British Columbia Power and Electric Company has applied for the right to divert 1,500 cubic feet of water per second at the canyon for power purposes, but the scheme of development does not seem to be very well defined as yet.

A gauging station was established in November, 1913, by the British Columbia Hydrographic Survey, at the highway bridge near the mouth of the river. It will give the flow of the stream at that point. This is some 5 miles below the canyon, and one or two small creeks enter in that distance. If the flow through the canyon is required, it can probably be determined by applying

a suitable coefficient to the flow as given at the gauging station. A few comparative measurements would determine the value of this coefficient. It would have been difficult to establish a suitable gauging station in the canyon, and almost inpossible to get a regular gauge reader for such a station.

DISCHARGE MEASUREMENTS of Cheakamus Creek, near Mouth, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Nov. 29......	H. J. E. Keys................	1046	75	443	5·97	4·30	2640

GREEN RIVER AT NAIRN FALLS.

Location.—At Nairn falls, about 5 miles from the mouth of Green river and Agerton post office, and about 60 miles up the Pacific Great Eastern railway from Squamish (Newport).

Records Available.—One meter measurement in 1913. Regular gauge readings since November, 1913, can possibly be used when sufficient meter measurements have been made.

Winter Conditions.—Open all year.

Gauge.—Inclined staff gauge fastened by means of holes drilled in the rock. Daily gauge readings.

Channel.—Channel is being changed to quite an extent by railroad constructions along the west bank.

Discharge Measurements.—One meter measurement.

Accuracy.—Results will not be very accurate until the railroad construction is completed.

GREEN RIVER.

Green river has its source in Green lake at an elevation of 2,080 feet. It discharges into Lillooet river near Agerton at an elevation of 700 feet, and forms part of the Harrison-Fraser drainage. Onemile creek, Sixmile creek and Soo river (Eightmile creek) enter from the west.

The drainage areas are measured from the provincial map of 1912 (scale 17·75 miles to 1 inch). The area above the mouth is 200 square miles. Nairn falls are about 5 miles from the mouth of the river, and it is at this point that the gauging station has been established, The area above the falls is about 180 square miles.

The precipitation in the Green River valley is fairly heavy, and there is a moderate snowfall in the winter. Green lake is frozen over for several months but the river being quite swift remains open.

The Green River valley forms part of the route of the Pacific Great Eastern railway, which is to run from Vancouver and Newport, on the coast, through Pemberton Meadows and Lillooet to Fort George. This road follows fairly closely the old pack trail from Howe sound to Pemberton Meadows, and during the construction of the railroad this trail was developed into a road. The completion of the railroad should provide good transportation facilitates in the valley.

At the summit, between Cheakamus river and Green river, there are four lakes, two of which feed Green river. The largest of these, Green lake, is some 4 miles in length. The railroad is being built around the eastern shore, and the

wagon road runs on the west. The locality is quite picturesque, and there is plenty of good fishing and hunting, An enterprising pioneer has established a summer resort on this lake, and expects that it will be well patronized.

Between Green lake and the mouth of the river, a distance of some 17 miles, there is a total fall of 1,400 feet. The stream is very rapid and turbulent. Two important tributaries, Soo river and Sixmile creek, enter below the lake.

About 5 miles from the mouth, the river falls through a narrow rocky gorge, giving a drop of some 170 feet in less than a quarter of a mile. At this point it is proposed to develop hydro-electric power. A small intake dam would provide for the diversion of the water into a short flume and penstock, which would lead to the power-house situated below the falls. This would provide for a head of about 170 feet. There would be very little pondage at the intake. The presence of the railroad a few feet above high water would prevent the full utilization of Green lake storage. The main flow, however, comes from Soo river and Sixmile creek, and it would probably be possible to develop storage on these streams.

Gauging stations were established at Green falls and at Green lake in November, 1913. Stations were established also on the tributaries, Soo river and Sixmile creek, in March, 1914. The station at the falls gives the unregulated flow of the river at the intake site and the other three stations show the distribution of this flow. These stations show the amount of power available with the natural flow of the stream, and also the relative conditions of storage facilities on the tributaries.

DISCHARGE MEASUREMENTS of Green River, Nairn Falls, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Nov. 18........	H. J. E. Keys and C. G. Cline	1,046	84	264	3·4	2·1	918[1]

NOTE.—[1]Station established.

GREEN RIVER AT GREEN LAKE.

Location.—At outlet of Green lake about 45 miles up the Pacific Great Eastern railway from Squamish (Newport).

Records Available.—One meter measurement in 1913. Regular gauge readings since November, 1913, will be available when sufficient meter measurements have been made.

Winter Conditions.—Lake freezes over, but the stream is open at the gauge.

Gauge.—Vertical staff gauge spiked to stringer of highway bridge; daily gauge readings.

Channel.—Rocky channel..

Discharge Measurements.—One meter measurement.

Accuracy.—Results should be fairly accurate as soon as meter measurements are made.

DISCHARGE MEASUREMENTS of Green River, at Lake, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
1913							
Nov. 23	H. J. E. Keys	1,046	26.	51·3	3·0	1·32	152[1]

[1]NOTE.—Station established.

HIXON CREEK ABOVE BELKNAP CREEK.

Location.—Section 36, township 6, range 7, west of 7th meridian.

Records Available.—Three meter measurements during 1913.

Winter Conditions.—Very heavy snowfalls, but little ice in stream. Open water conditions practically all year.

Gauge.—Vertical Staff. No readings.

Channel.—Bed of stream covered with rocks and boulders. Water swift at higher stages.

Discharge Measurements.—Three measurements during 1913.

Accuracy.—Meter measurements good. No gauge readings.

DISCHARGE MEASUREMENTS of Hixon Creek above mouth of Belknap Creek, Left Fork, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
July 8	H. C. Hughes	1,673	23	31·2	1·34	1·41	42·1
July 31	do	1,673	24	12·8	0·71	1·15	9·8
Sept. 22	F. MacLachlan	1,673	21	12·3	0·49	0·90	6·1

LILLOOET RIVER.

Location.—At highway bridge, near Agerton post office, about 5 miles above Lillooet lake.

Records Available.—One meter measurement only. Regular gauge readings since November, 1913, may be available as soon as sufficient meter measurements have been taken.

Winter Conditions.—The stream was frozen over at the gauging station for part of January and most of February in 1914.

Gauge.—Vertical staff gauge spiked to face of bridge pier. Readings daily.

Channel.—Sandy bed.

Discharge Measurements.—One meter measurement in 1913.

Accuracy.—Possibility of backwater influence from Lillooet lake or of a shifting channel.

LILLOOET RIVER.

Lillooet river rises in the hills north of Jervis inlet at an elevation of from 8,000 to 10,000 feet. It discharges into Harrison lake near Port Douglas at an elevation of 40 feet, and forms part of the Harrison-Fraser drainage.

The tributaries entering from the southwest are: Spring creek, Fire creek, Glacier creek, and Green river. The Birkenhead creek enters from the north. There are also other unnamed tributaries.

The drainage areas are measured from the provincial map of 1912 (scale 17.75 miles to 1 inch). The area above the mouth is 2,200 square miles; above the lower end of Lillooet lake, 1,600 square miles; above the upper end of the lake, 1,300 square miles. The gauging station is situated about 5 miles above the lake, and the drainage area above it is about 800 square miles, or approximately one third of the total drainage.

The precipitation is fairly heavy in the Lillooet valley, and no irrigation is necessary. There is considerable snow and ice above Lillooet lake, and the stream is frozen over for several months in the winter time.

Lillooet river has a total length of about 100 miles. This is divided into approximately two equal parts by Lillooet lake. This lake has a length of about 20 miles and an area of 25 square miles. There is a small settlement at Port Douglas at the mouth of the river, but the more important part of the Lillooet valley lies above Lillooet lake, and is known as Pemberton Meadows.

At one time the lower Lillooet river and lake formed part of the trail to the Cariboo country. At that time Port Douglas was founded and attained considerable importance for a while, since it was at the head of navigation on Harrison lake and river. After the building of the wagon road via Spences Bridge and Ashcroft, of course the Lillooet route was no longer used except locally.

Pemberton Meadows could be reached by one of three routes. There was a pack trail from the head of Howe sound, up the Cheakamus river, across the divide and down Green river; there was a pack trail up Lillooet river from Harrison lake to Lillooet lake; and also a trail from the town of Lillooet and along Seaton and Anderson lakes, which followed down Birkenhead creek. The two former routes give access to the coast, and the latter to the interior. With the projection of the Pacific Great Eastern railway, transportation facilities from the new town of Newport (Squamish) at the head of Howe sound, through Pemberton Meadows to Lillooet were improved, and the trail was finally developed into a wagon road. When the railroad is built by this route it will provide easy access to Pemberton Meadows, and give direct railroad connection between Lillooet and the coast.

At Pemberton Meadows there is quite a block of valuable agricultural land. Good crops are grown at present on the higher ground. Hay and potatoes seem to be the principal products and considerable quantities were grown during 1913 to supply the railway camps. Previous to that time the productions were mainly for local use, on account of the cost of transportation, and more attention was paid to raising cattle and horses. With the completion of the railroad, both these industries will probably be greatly increased.

A great deal of the Pemberton Meadow land is subject to flooding from the Lillooet river. For several miles above Lillooet lake the stream winds through flat meadows, and has very little fall. The silt deposited by the river has built up the banks of the stream above the level of the surrounding meadows. When the stream rises high enough to flood its banks the river spreads out over the farms and prevents the land being worked to the best advantage. A few small dykes have been constructed, but no general scheme of reclamation has as yet been attempted. A project is being considered at present by ranchers and others to control the river and provide for the reclamation of this land. The proposed scheme includes a lowering of the outlet of Lillooet lake and the dredging of the Lillooet river for several miles above the lake, together with the construction of levees along both banks of the river. Partial surveys have been made for this scheme, but no start has been made on the actual construction work.

In connection with this reclamation scheme the British Columbia Hydrographic Survey was requested to make measurements on the Lillooet river to

determine the volume of water which would have to be handled. A station was established at the highway bridge a few miles above Lillooet lake on November 16, 1913. Regular gauge readings are being taken, and a series of meter measurements is to be made so as to give complete records of the stream flow.

DISCHARGE MEASUREMENTS of Lillooet River, near Pemberton Meadows, 1913.

Date.	Hydrographer.	Meter No.	Gauge Height.	Discharge.
1913			Feet.	Sec.-ft.
Nov 16........	H. J. E. Keys..	1,046	1·83	1,693

LYNN CREEK.

Location.—Above North Vancouver intake, and about 4 miles from the mouth of the creek.

Records Available.—Meter measurement only. Regular gauge readings have been taken since November 3, 1913, and will be available when sufficient meter measurements have been made.

Winter Conditions.—Open water all season.

Gauge.—Vertical staff gauge.

Channel.—Rocky.

Discharge Measurements.—One meter measurement in 1913; also one by Mr. E. A. Cleveland in 1909, which is not referred to the gauge.

Accuracy.—When sufficient measurements have been made the results should be quite accurate.

LYNN CREEK.

Lynn creek has its source in Lynn lake at an elevation of 2,500 feet, and discharges into Burrard inlet, near North Vancouver, at sea-level. Its drainage area above the North Vancouver intake is estimated by the engineers of the Provincial Water Rights Branch as being about 17 square miles. The stream furnishes the water supply for the municipality of North Vancouver. The precipitation is probably about 100 inches. In the winter time there is snow in the higher altitudes.

Lynn creek watershed lies between the lower portions of the Seymour and Capilano watersheds and directly north of North Vancouver. The watershed is mountainous and well timbered and there is considerable snow storage. The quality of the water is excellent and the streams provide a food supply for North Vancouver during most of the year. It may be necessary to provide storage as the demands of the municipality increase.

A gauging station was established by the British Columbia Hydrographic Survey in November, 1913, to measure the flow of the stream at the intake. Daily gauge readings are being taken. During 1912 sufficient meter measurements will be made to develop a rating curve and so render the gauge readings available. One measurement was made in 1913 giving a flow of 58 cubic feet per second as shown below.

DISCHARGE MEASUREMENTS of Lynn Creek, above City intakes, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
1909							
Aug. 4..........	Mr. E. Cleveland...........	....	....	....	....	....	57
1913							
Nov. 3..........	H. J. E. Keys..............	1,057	27	38	1·5	1·73	58·5

SEYMOUR CREEK.

Location.—At the Vancouver water works intake, and about 7 miles from the mouth of the creek.

Records Available.—Two measurements in 1909 and one in 1913. Regular gauge readings have been taken since November 6, 1913, and these will be available when sufficient meter measurements have been made.

Winter Conditions.—Open water all year.

Gauge.—Vertical staff gauge—readings daily.

Channel.—Rocky—water swift at higher stages.

Discharge Measurements.—One meter measurement referred to gauge, more to be taken during 1914.

Accuracy.—A good set of measurements should give accurate results.

SEYMOUR CREEK.

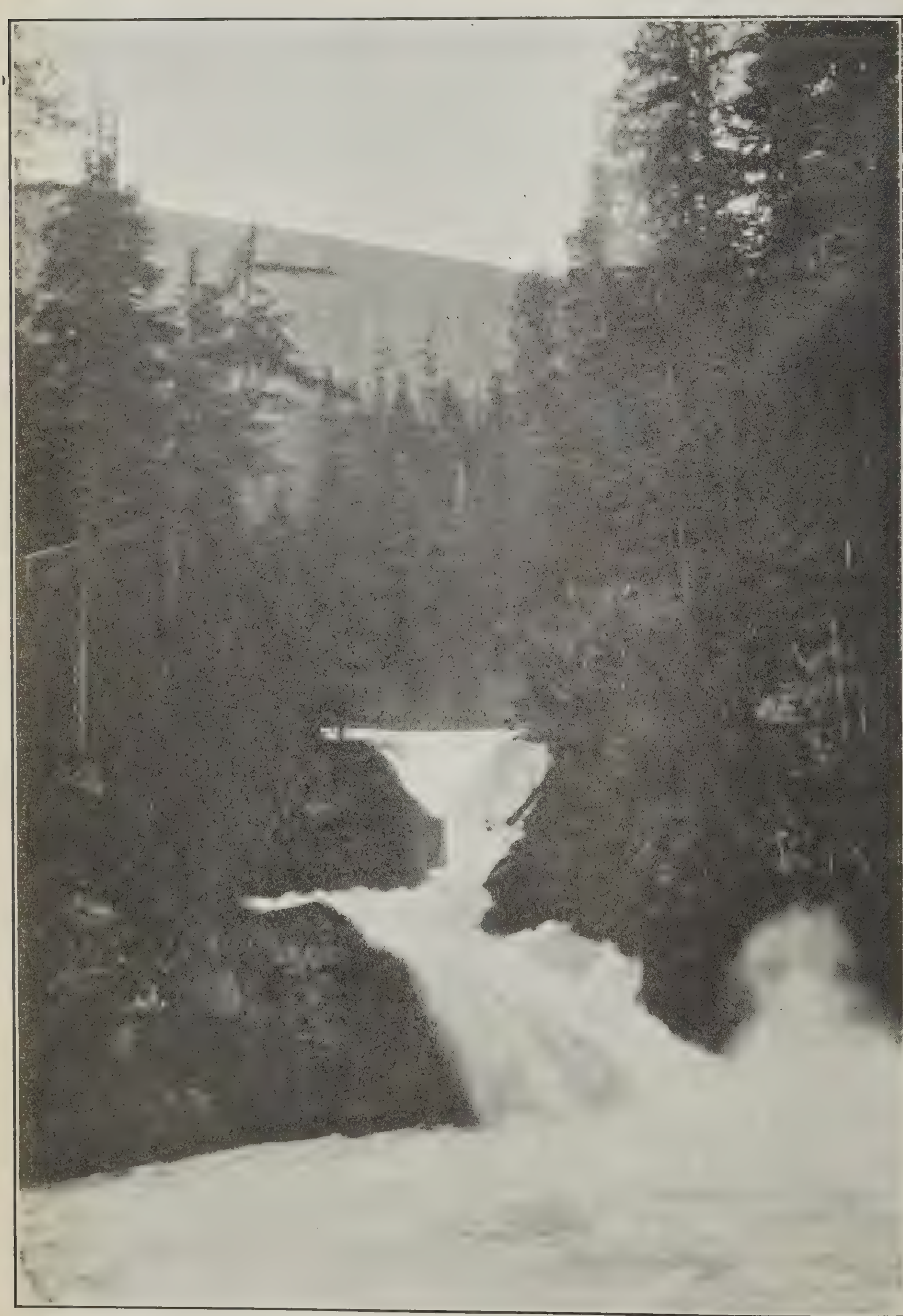
Seymour creek has its source in Loch Lomond (Summit lake) at an elevation of 3,300 feet, and discharges into Burrard inlet, near North Vancouver, at sea level. Its more important tributaries are Stoney creek and the East and West Forks. The drainage area above Vancouver intake is estimated by the engineers of the Provincial Water Rights Branch at 76 square miles. The water is used for supplying the city of Vancouver. Below the intake shingle bolts are floated down to Burrard inlet.

The precipitation is probably over 100 inches. In the winter time there are heavy snowfalls in the hills, and snow remains in some places all the year round. The stream does not freeze over at the waterworks intake.

Seymour creek is a swift mountain stream, with clear pure water flowing from a well-timbered mountainous watershed. There is no settlement above the intake, and hence no chance for the pollution of the water. On the higher altitudes, and as low as 3,000 feet above sea-level, snow remains in large quantities throughout the whole year. This snow storage plays an important part in regulating the flow of the stream, for the snow melts in the summer and provides a good supply of water at a time when the stream would otherwise be low. There are places, also, where artificial storage reservoirs could be made.

The waterworks intake is situated some 7 miles from the mouth of the creek. It is a substantial timber structure, fitted with screens and control gates. At the entrance to the pipes there is a settling basin provided with regulating gates and spillways. The pipelines follow the creek valley and cross Burrard inlet there at the Second Narrows.

There is a good road up Seymour creek as far as the waterworks intake. From there, there is a foot trail for several miles farther. People from Vancouver and other places often go camping and mountain climbing in the valley, but strict rules are imposed on all such to prevent contamination of the water supply.



Seymour River—Falls 5 miles from the settlement of Seymour Arm, 35 feet drop.

A gauging station was established in November, 1913, by the British Columbia Hydrographic Survey at the waterworks intake, and regular records of the flow of the stream are being kept. The gauge is a vertical staff attached to the face of the timber cribbing just above the intake opening. Meter measurements are made from a light cable equipment, some 200 feet above the gauge. At low water, measurements are made by wading. During 1914 sufficient measurements will be made to develop a rating curve and render the gauge readings available. In the meantime the meter measurements already taken are listed below.

Discharge Measurements of Seymour Creek, above City intakes, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1909			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Aug. 4........	M. Cleveland..............	....	....	....	....	....	367
Aug. 16........	do	....	....	....	....	....	21
1913							
N v. 6.	H. J. E. Keys..............	....	67	133	....	2·60	282

SLOLLICUM CREEK.

Location.—Near mouth of stream below falls near Harrison lake in section 19, township 5, range 28, west of 6th meridian.

Records Available.—One meter measurement only.

Winter Conditions,—Open water all year.

Gauge.—No gauge.

Channel.—Rocks and gravel.

Discharge Measurements.—One measurement not referred to any gauge.

Accuracy.—The meter measurement merely gives the discharge on the day it was made and is of course quite accurate for such a purpose.

SLOLLICUM CREEK.

Slollicum creek rises near the base of Slollicum mountain on the east side of Harrison lake at an elevation of some 2,050 feet. It discharges into Cascade bay, an arm of Harrison lake, at about 40 feet above sea-level. It is part of the Harrison-Fraser drainage. There is a small lake on one of the branches of the creek.

The rainfall in the Slollicum creek watershed will be considerably greater than that given by the meteorological station at Agassiz. The mean annual rainfall at Agassiz is 67 inches, so that probably at Slollicum creek there would be from 75 to 100 inches, depending on the altitude. In the winter there is quite a heavy snowfall, and the stream freezes over in the upper part of the watershed. Near the mouth, however, the falls keep the stream open, though masses of ice are formed by the spray.

Near the mouth of the stream there is a series of very high falls, the largest of which has a drop of nearly 200 feet, and the total fall in less than half a mile is 2,000 feet. The stream is quite small, but a considerable amount of power could be developed quite cheaply on account of the high head. A meter measurement taken on September 17, 1913, gives a discharge of 20 cubic feet per second.

The minimum flow may be slightly less than this amount, but with a small amount of storage, probably a mean flow of 20 c.f.s. could be maintained. At 2,000 feet this would give some 16,000 horsepower.

Slollicum creek is only 6 miles from Harrison Hot Springs and the St. Alice hotel. The falls are quite an attraction to the guests at the hotel, and it is a fine trip across the lake by motor launch.

Discharge Measurements of Slollicum Creek, at Mouth, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Sept. 17........	K. G. Chisholm.............	1,055	14	12·6	1·55	....	20

REPORT

OF

BRITISH COLUMBIA HYDROGRAPHIC SURVEY FOR 1913

CHAPTER 6

Kamloops Division—Hydrographic Data

CHAPTER VI.

KAMLOOPS DIVISION.

REGULAR METERING STATIONS.

ADAMS RIVER.

Location.—Section 6, township 23, range 12, west 6th meridian.

Records Available.—1st July to August 31 1911; 1st January to December 31, 1912; 1st January to December 31, 1913.

Winter Conditions.—Partial ice conditions exist during winter months, but river is seldom frozen over at the gauge sufficiently to have a material effect on the accuracy of returns. Severe spells of cold weather are generally of short duration.

Gauge.—A vertical staff gauge read daily by Mrs. Sturgill. On account of sluicing operations of the Adams River Lumber Company, sudden changes of gauge height due to the opening or closing of the storage dam on Adams lake probably escape the observer's notice, and consequently gauge readings may be slightly inaccurate.

Channel.—The channel varies in width from 300 to 500 feet above the dam, where meterings are made. The velocities are uniform, the mean never exceeding 3.0 feet per second at the measuring section. The run-off is artificially controlled by a dam near the outlet of Adam's lake.

Discharge Measurements.—The gauge-height-discharge curve is rated by well distributed meterings.

Accuracy.—The accuracy of results attached would be very high if gauge readings could be relied upon. As pointed out above, this is an uncertain source of error. It is probable, however, that results given are for the most part within 10 per cent of the truth.

It is proposed to instal a self-recording gauge at this station during 1914 to obviate possible difficulty from the source referred to above.

ADAMS RIVER.

Adams river has its source in Adams lake, at an elevation of 1340 feet and, flowing in a southerly direction, discharges into Shuswap lake near the town of Chase, at an elevation of 1,153 feet. The following tributaries enter from the west, going upstream: Bear creek, Bush creek, Pass creek, and upper Adams river; Nikwikwaia creek enters from the east. Adams river is a part of the Shuswap lake-Thompson river drainage. The drainage area, as measured from a provincial map, scale 20 miles to 1 inch, is 1,700 square miles; of this area, Adams lake constitutes 60 square miles. The water is used extensively for logging by the Adams River Lumber Company.

The Upper Adams river rises in Tum-Tum lake about 80 miles north of the main line of the C.P.R. near Chase. From this lake it flows in a southerly direction for about 40 miles into Adams lake, a magnificent sheet of water, 40 miles long, a mile and a half wide, surrounded by high mountains. The lake rises 4 to 5 feet above its low-water level, high water taking place in June. There

Adams River—Adams River Lumber Company's Dam below Adams Lake.

is some agricultural land around the lake, but it is sparsely settled, and if it were desirable to use the lake as a storage reservoir for water-power purposes, and retain the lake at its high-water level, no important interests would be affected. At its southerly end, Adams lake empties into Adams river, where it falls 190 feet into Shuswap lake in the short distance of 6 miles.

There are large areas of valuable timber along Adams lake and its several tributaries. The Adams River Lumber Company is the largest operating company. This company has constructed a dam on Adams river, about one quarter of a mile from the outlet of the lake, for log driving purposes. The dam is rock-filled, timber-cribbed, about 180 feet long and 15 feet high; it has six sluice-gates, and a fish ladder.

On account of the excellent storage of Adams lake, it will be easy to conserve the greater part, if not all, of the run-off from season to season. The total discharge of 1912 will give a good daily mean for that period; the year 1912, however, is above the normal in run-off in this locality, and so should not be taken as representative of an average year.

The Adams River station was established June 31, 1911, by C. E. Richardson. The measuring section is located 250 yards above the Adams River Lumber Company dam, and 25 yards above the old wing dam. The gauge is a vertical staff gauge (fir) 2 inches by 4 inches by 8 feet marked in feet and tenths with black paint. It is fastened to a rock-filled crib, 7 feet high, which was built to protect the gauge from logs and ice. The crib is situated in a back-eddy on the right bank, 75 yards, below the dam. The measurements are made by means of the following equipment: a $\frac{3}{8}$-inch mild steel cable is stretched across the river, 20 feet down stream a tag line of $\frac{1}{8}$-inch mild steel cable is stretched across and pulled taut. A boat is fastened by rope to the larger cable, and allowed to rest directly below the tag line. Measurements are made every 20 feet.

This is an excellent measuring section; there is only one channel, with a permanent bed; the banks are good and the current is even. The datum of the gauge is referred to three bench-marks.

Monthly Discharge of Adams River below Adams Lake for 1913.

(Drainage area, 1,700 square miles).

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
January	175	160	160	0·09	0·10	9,838
February	160	160	160	0·09	0·09	8,885
March	2,290	160	658	0·39	0·45	40,459
April	2,400	160	1,521	0·89	0·99	90,510
May	8,300	2,290	3,484	2·05	2·36	214,220
June	13,800	4,400	9,710	5·71	6·37	577,790
July	5,900	1,050	5,039	2·96	3·41	309,840
August	10,300	1,050	3,406	2·00	2·31	209,420
September	4,400	910	3,309	1·95	2·18	196,900
October	1,270	885	1,009	0·59	0·68	62,040
November	2,870	1,350	1,932	1·14	1·27	114,960
December	1,970	250	824	0·48	0·55	50,666
The year	13,800	160	2,601	1·53	20·76	1,885,528

Daily Gauge Heights and Discharges of Adams River below Adams Lake for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	−0·2	175	−0·3	160	−0·3	160	3·0	2,290	3·3	2,700	4·9	8,300
2	−0·3	160	−0·3	160	−0·3	160	3·0	2,290	3·2	2,540	4·9	8,300
3	−0·3	160	−0·3	160	−0·3	160	3·0	2,290	3·2	2,540	5·0	8,800
4	−0·3	160	−0·3	160	−0·3	160	3·1	2,400	3·1	2,400	5·1	9,300
5	−0·3	160	−0·3	160	−0·3	160	3·1	2,400	3·1	2,400	5·2	9,800
6	−0·3	160	−0·3	160	−0·3	160	3·1	2,400	3·0	2,290	5·3	10,300
7	−0·3	160	−0·3	160	−0·3	160	3·1	2,400	3·0	2,290	5·3	10,300
8	−0·3	160	−0·3	160	−0·3	160	−0·3	160	3·0	2,290	5·4	10,800
9	−0·3	160	−0·3	160	−0·3	160	−0·3	160	3·0	2,290	5·4	10,800
10	−0·3	160	−0·3	160	−0·3	160	−0·3	160	3·0	2,290	5·5	11,300
11	−0·3	160	−0·3	160	−0·3	160	−0·3	160	3·1	2,400	5·6	11,800
12	−0·3	160	−0·3	160	−0·3	160	−0·3	160	3·1	2,400	5·6	11,800
13	−0·3	160	−0·3	160	−0·3	160	−0·2	175	3·2	2,540	5·7	12,300
14	−0·3	160	−0·3	160	−0·3	160	−0·2	175	3·2	3,540	5·8	12,800
15	−0·3	160	−0·3	160	2·7	1,970	−0·2	175	3·3	2,700	5·8	12,800
16	−0·3	160	−0·3	160	2·7	1,970	−0·2	175	3·4	2,870	5·8	12,800
17	−0·3	160	−0·3	160	2·7	1,970	−0·2	175	3·5	3,070	5·9	13,300
18	−0·3	160	−0·3	160	2·7	1,970	−0·2	175	3·5	3,070	5·9	13,300
19	−0·3	160	−0·3	160	2·7	1,970	−0·2	175	3·6	3,290	5·9	13,300
20	−0·3	160	−0·3	160	−0·3	160	−0·2	175	3·8	3,290	6·0	13,800
21	−0·3	160	−0·3	160	−0·3	160	−0·2	175	3·6	3,290	6·0	13,800
22	−0·3	160	−0·3	160	−0·3	160	−0·2	175	3·8	3,770	5·9	13,300
23	−0·3	160	−0·3	160	−0·3	160	3·7	3,520	3·8	3,770	4·2	5,120
24	−0·3	160	−0·3	160	−0·3	160	3·7	3,520	3·8	3,770	4·2	5,120
25	−0·3	160	−0·3	160	−0·3	160	3·7	3,520	3·9	4,080	4·1	4,750
26	−0·3	160	−0·3	160	−0·3	160	3·7	3,520	3·9	4,080	4·0	4,400
27	−0·3	160	−0·3	160	−0·3	160	3·6	3,290	4·0	4,400	4·0	4,400
28	−0·3	160	−0·3	160	−0·3	160	3·6	3,290	4·1	4,750	4·0	4,400
29	−0·3	160	....	....	3·0	2,290	3·5	3,070	4·8	7,800	....	....
30	−0·3	160	....	....	3·0	2,290	3·4	2,870	4·8	7,800	....	....
31	−0·3	160	....	....	3·0	2,290	...	...	4·9	8,300	...	....

Daily Gauge Heights and Discharges of Adams River below Adams Lake for 1913—*Concluded.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	....	1·6	1,050	3·8	3,770	....	1,270	....	1,435	2·7	1,970
2	....	....	1·6	1,050	3·8	3,770	....	1,270	....	1,435	2·7	1,970
3	....	....	1·7	1,120	3·4	2,870	....	1,200	....	1,435	2·7	1,970
4	....	....	1·7	1,120	3·8	3,770	....	1,200	....	1,435	2·6	1,870
5	....	....	5·3	10,300	3·8	3,770	....	1,200	....	1,350	2·6	1,870
6	....	....	5·3	10,300	3·65	3,405	....	1,145	....	1,350	2·6	1,870
7	....	....	1·7	1,120	3·5	3,070	....	1,145	....	1,350	2·5	1,770
8	....	....	1·9	1,270	4·0	4,400	....	1,145	....	1,350	2·5	1,770
9	....	....	1·9	1,270	3·9	4,080	....	1,090	....	1,350	2·4	1,670
10	....	....	1·9	1,270	3·9	4,080	....	1,090	....	1,645	2·4	1,670
11	....	5,000	1·9	1,270	3·9	4,080	....	1,035	....	1,645	0·1	250
12	....	sec.-ft.	2·0	1,345	3·8	3,770	....	985	....	1,535	0·1	250
13	....	probably	2·0	1,345	3·8	3,770	....	985	....	1,535	0·1	250
14	....	mean	2·0	1,345	3·75	3,645	....	935	....	1,535	0·1	250
15	....	this	2·0	1,345	3·75	3,645	....	935	....	1,535	0·1	250
16	....	period.	2·0	1,345	3·7	3,520	....	935	....	1,535	0·1	250
17	....		3·8	3,770	3·7	3,520	....	935	3·4	2,870	0·1	250
18	....	....	3·8	3,770	3·7	3,520	....	935	3·4	2,870	0·1	250
19	....	....	4·3	5,520	3·7	3,520	....	935	3·4	2,870	0·1	250
20	....	5,900	4·3	5,520	2·55	1,820	....	885	3·4	2,870	0·2	280
21	....	5,650	3·7	3,520	1·40	910	....	885	3·3	2,700	0·2	280
22	....	5,650	3·7	3,520	3·6	3,290	....	885	3·3	2,700	0·2	280
23	....	5,650	3·7	3,520	....	3,000	....	885	3·3	2,700	0·2	280
24	....	5,650	4·5	5,520	....	3,000	....	885	2·9	2,180	0·2	280
25	....	5,400	4·3	5,520	....	3,000	....	885	2·9	2,180	0·2	280
26	....	5,400	4·2	5,120	....	3,000	....	935	2·9	2,180	0·2	280
27	....	5,400	4·2	5,120	....	3,000	....	935	2·9	2,180	0·2	280
28	....	5,150	4·1	4,750	3·4	2,870	....	935	2·8	2,070	0·2	280
29	....	5,150	4·0	4,400	3·5	2,700	....	935	2·8	2,070	0·2	280
30	....	5,150	3·9	4,080	3·3	2,700	....	935	2·8	2,070	1·6	1,050
31	1·6	1,050	3·9	4,080	....	....	....	935	....	....	....	1,050

BARNES CREEK, NEAR ASHCROFT.

Location of Station.—Section 11, township 20, range 24, west 6th meridian, about 5 miles southeast of Ashcroft, and just above Barnes lake.

Records Available.—April 26, 1912, to September 14, 1912; May 1, 1913, to December 14, 1913.

Winter Conditions.—Light snowfall and short periods of severe cold.

Gauge.—Vertical staff gauge 5 feet in height, referred to bench-marks. Gauge readings have been taken daily during the irrigation season by John Smith, Ashcroft.

Channel.—The stream is straight for about 100 feet above the measuring section and for 50 feet below it. The water is swift and is well confined by the bridge approaches.

Discharge Measurements.—Measurements are made by wading at the downstream side of the traffic bridge.

Accuracy.—Results as shown are accurate, as fair conditions for metering and gauge readings existed.

BARNES CREEK.

Barnes creek (sometimes called Pennies or Penneys creek) has its source in the hills east of Ashcroft, at an elevation of 4,000 feet. It discharges into the Thompson river from the south, 4 miles east of Ashcroft, at an elevation of 960 feet, and is part of the Thompson River drainage. The drainage area

above the mouth is 38 square miles, and above the gauging station it is 35 square miles. The water is used for irrigation. It is a contentious stream, almost drying up in July and August. It lies in the dry belt, with a mean annual precipitation of about 9 inches. The summers are hot and dry, and the winters cold and dry.

Barnes creek is about 12 miles long, about 12 feet wide, and its depth varies from 0·5 foot at low water to 1·7 foot at high water. Its mean velocity at high water is 3·5 feet per second.

The discharge fluctuates from practically zero in the winter to a maximum of about 50 or 60 cubic feet per second in the spring freshet during the middle of May. Then it declines rapidly until it becomes as low as from 3 to 4 second-feet about July 1, and all through the month. In the fall it rises for a short time, then recedes as winter and the cold weather comes in.

Water is diverted from Barnes creek near the headwaters, and is stored in the Twin lakes for use, near Walhachin. There is another diversion to Barnes lake. From Barnes lake the water may be returned to Barnes creek, for use farther down the stream, or it may be run into Nelson creek for use in that direction. Usually there is a shortage of water on Barnes creek. But in 1912 Barnes lake filled and over-flowed and the water users were forced to ask that water be diverted to Twin lakes, though they had previously taken out an injunction against it.

The gauging station on Barnes creek is 200 yards above Barnes lake and 5 miles southeast of Ashcroft, B.C. It was established April 26, 1912, by C.G. Cline, and daily gauge readings were taken till the end of the irrigation season. The gauge is situated 150 feet above the first highway bridge over the main stream above Barnes lake. It is a 5-foot staff gauge nailed to a small tree on the right bank of the creek. The measurements were made by wading at the downstream side of the bridge. The stream is straight for about 100 feet above the measuring section, and for 50 feet below it. The water is swift. The road has been built up to form the approaches to the bridge, and there is no danger of overflow. There is only one channel. which is about 6 inches deep at ordinary low water. The river just below the gauge should be examined occasionally to see that brush and logs do not collect on it and so back the water up on the gauge. This station gives the whole flow of the stream except what is diverted into the Twin lakes, near the headwaters of the stream, by the British Columbia Horticultural Estates of Walhachin.

MONTHLY DISCHARGE of Barnes Creek above Barnes Lake, for 1913.

(Drainage area, 38 square miles).

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet
May	23	4	13·2	0·35	0·40	812
June	44	5	16·8	0·44	0·49	1,000
July	35	2	13·3	0·35	0·40	818
August	19	2	5·7	0·15	0·17	350
September	4	2	2·4	0·06	0·07	143
October	4	3	3·6	0·10	0·11	211
November	4	3	3·4	0·09	0·10	202
December	....	....	....	....	....	266 Estimated

Discharge Measurements of Barnes Creek above Barnes lake, for 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
May 2	K. G. Chisholm	1,055	10	5·0	1·05	0·43	5·3
June 13	do	1,055	9	4·95	1·16	0·45	5·7
Aug. 14	do	1,055	7·5	3·75	1·09	0·40	4·1

Daily Gauge Heights and Discharges of Barnes Creek above Barnes lake, for 1913.

Day.	May.		June.	
	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	5	0·6	12
2	0·45	5	0·6	12
3	0·4	4	0·6	12
4	0·4	4	0·55	10
5	0·4	4	0·55	10
6	0·45	5	0·5	7
7	0·4	4	0·5	7
8	0·4	4	0·5	7
9	0·6	12	0·5	7
10	0·7	19	0·5	7
11	0·65	15	0·5	7
12	0·6	12	0·45	5
13	0·6	12	0·45	5
14	0·55	10	·45	5
15	0·6	12	0·45	5
16	0·6	12	0·6	12
17	0·6	12	0·6	12
18	0·65	15	0·55	10
19	0·65	15	0·55	10
20	0·75	23	0·55	10
21	0·7	19	0·55	10
22	0·75	23	0·75	23
23	0·75	23	1·00	44
24	0·75	23	0·95	40
25	0·7	19	0·95	40
26	0·7	19	0·9	35
27	0·7	19	0·9	35
28	0·7	19	0·9	35
29	0·65	15	0·9	35
30	0·65	15	0·9	35
31	0·6	12	....	....

Daily Gauge Heights and Discharges of Barnes Creek above Barnes lake, for 1913—*Concluded.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	0·9	35	0·3	2	0·3	2	0·35	3	0·4	4	0·35	3
2	0·85	31	0·3	2	0·3	2	0·35	3	0·4	4	0·4	4
3	0·8	27	0·3	2	0·3	2	0·35	3	0·4	4	0·4	4
4	0·8	27	0·3	2	0·3	2	0·35	3	0·4	4	0·4	4
5	0·75	23	0·3	2	0·3	2	0·35	3	0·4	4	0·4	4
6	0·75	23	0·3	2	0·3	2	0·35	3	0·4	4	0·4	4
7	0·7	19	0·3	2	0·3	2	0·35	3	0·4	4	0·4	4
8	0·7	19	0·3	2	0·3	2	0·35	3	0·4	4	0·4	4
9	0·6	12	0·3	2	0·3	2	0·35	3	0·4	4	0·4	4
10	0·6	12	0·3	2	0·3	2	0·35	3	0·4	4	0·4	4
11	0·7	19	0·3	2	0·3	2	0·35	3	0·4	4	0·4	4
12	0·7	19	0·35	3	0·3	2	0·4	4	0·4	4	0·4	4
13	0·7	19	0·4	4	0·3	2	0·4	4	0·4	4	0·4	4
14	0·65	15	0·4	4	0·3	2	0·4	4	0·35	3	0·4	4
15	0·65	15	0·4	4	0·3	2	0·4	4	0·35	3	....	....
16	0·65	15	0·4	4	0·3	2	0·4	4	0·35	3	....	....
17	0·6	12	0·6	12	0·3	2	0·4	4	0·35	3	....	....
18	0·6	12	0·7	19	0·3	2	0·4	4	0·35	3	....	....
19	0·55	10	0·7	19	0·3	2	0·4	4	0·35	3	....	....
20	0·5	7	0·65	15	0·3	2	0·4	4	0·35	3	....	....
21	0·5	7	0·6	12	0·3	2	0·4	4	0·35	3	....	....
22	0·4	4	0·6	12	0·4	4	0·4	4	0·35	3	....	....
23	0·4	4	0·55	10	0·4	4	0·4	4	0·35	3	....	....
24	0·4	4	0·55	10	0·4	4	0·4	4	0·35	3	....	....
25	0·4	4	0·5	7	0·4	4	0·35	3	0·35	3	....	....
26	0·4	4	0·45	5	0·35	3	0·4	4	0·35	3	....	....
27	0·4	4	0·4	4	0·35	3	0·4	4	0·35	3	....	....
28	0·4	4	0·4	4	0·35	3	0·4	4	0·35	3	....	....
29	0·3	2	0·35	3	0·35	3	0·4	4	0·35	3	....	....
30	0·3	2	0·3	2	0·35	3	0·4	4	....	....	....	....
31	0·3	2	0·3	2	0·35	....	0·4	4	....	....	....	....

BOLEAN CREEK.

Location.—Section 9, township 18, range 12, west 6th Meridian.

Records Available.—May 23 to December 31, 1911; January 1 to September 16, 1912; April 27 to September 19, 1913.

Winter Conditions.—Not very severe. Stream sometimes remains practically open all winter.

Gauge.—Vertical staff gauge read daily by Clement Stickney.

Channel.—The bed is of sand and gravel, the channel being about 25 feet in width. Flow varies from a recorded minimum of 6 second-feet (March 16, 1912) to a maximum of 412 second-feet (May 16 1912.)

Discharge Measurements.—Nine discharge measurements have been made, but the curve is not very well defined.

Accuracy.—Accuracy of results appended is low, but they are probably within 15 per cent of obtaining conditions.

Discharge Measurements of Bolean Creek, near Slahaltkan, for 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1911.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
May 23......	W. M. Carlyle...............	1,044	24	58·5	3·15	2·2	183
June 16......	do	1,044	24	48·4	2·63	1·95	127
July 12......	do	1,044	23	34·6	2·5	1·81	87
" 26......	do	1,044	17	15·1	1·34	1·24	[1]20·3
Aug. 2......	do	1,044	16	11·8	0·86	1·02	10·1
1912.							
May 13......	C. E. Richardson...........	1,048	25	61·2	4·3	2·55	262·9
July 16......	do	1,048	23	518·9	1·66	1·39	31·4
1913.							
April 23......	H. J. E. Keys...............	1,057	21	27·1	2·10	1·68	57
June 18......	do	1,057	28	29·3	2·80	2·10	82

NOTE.—[1] New section.

Monthly Discharge of Bolean Creek River near Slahaltkan for 1913.

(Drainage area, 80 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May..	292	30	161	2·02	2·33	9,900
June..	272	93	151	1·89	2·11	8,980
July..	179	26	67	0·84	0·97	4,120
August..	39	14	24	0·30	0·35	1,480

Daily Gauge Heights and Discharges of Bolean Creek near Slahaltkan for 1913.

Day.	April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	.....	.....	1·5	34	2·83	272
2	.....	.....	1·57	41	2·83	272
3	.....	.....	1·6	44	2·77	256
4	.....	.....	1·5	34	2·67	231
5	.....	.....	1·45	30	2·63	221
6	.....	.....	1·47	32	2·5	190
7	.....	.....	1·57	41	2·37	161
8	.....	.....	1·67	51	2·5	190
9	.....	.....	2·1	110	2·47	183
10	.....	.....	2·5	190	2·35	157
11	.....	.....	2·45	179	2·3	147
12	.....	.....	2·52	195	2·2	128
13	.....	.....	2·5	190	2·25	138
14	.....	.....	2·37	161	2·10	110
15	.....	.....	2·3	147	2·1	110
16	.....	.....	2·3	147	2·17	123
17	.....	.....	2·35	157	2·13	115
18	.....	.....	2·37	161	2·07	105
19	.....	.....	2·3	147	2·13	115
20	.....	.....	2·4	167	2·33	153
21	.....	.....	2·45	179	2·13	115
22	.....	.....	2·47	183	2·2	128
23	.....	.....	2·6	214	2·07	105
24	.....	.....	2·75	251	2·15	119
25	.....	.....	2·85	278	2·17	123
26	.....	.....	2·87	284	2·17	123
27	1·6	44	2·9	292	2·17	123
28	1·6	44	2·87	284	2·13	115
29	1·55	39	2·8	264	2·03	98
30	1·53	37	2·7	238	2·0	93
31	.....	.....	2·83	272	.....	.....

DAILY GAUGE HEIGHTS AND DISCHARGES of Bolean Creek near Slahaltkan for 1913—*Concluded.*

Day.	July.		August.		September.	
	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	2·07	105	1·43	28	1·2	14
2	2·03	98	1·37	24	1·15	12
3	1·9	79	1·43	28	1·2	14
4	1·85	73	1·35	23	1·3	20
5	1·77	60	1·35	23	1·3	20
6	1·7	54	1·35	23	1·25	17
7	1·65	49	1·35	23	1·23	16
8	1·63	47	1·5	34	1·2	14
9	1·6	44	1·47	32	1·25	17
10	1·65	49	1·43	28	1·2	14
11	1·93	83	1·35	23	1·15	12
12	1·85	73	1·35	23	1·15	12
13	1·95	86	1·35	23	1·15	12
14	2·45	179	1·35	23	1·15	12
15	2·27	141	1·37	24	1·15	12
16	2·17	123	1·35	23	1·15	12
17	2·07	105	1·4	26	1·15	12
18	1·97	89	1·47	32	1·2	14
19	1·87	75	1·55	39	1·15	12
20	1·77	60	1·47	32	....	....
21	1·67	51	1·4	26	....	....
22	1·65	49	1·35	23	....	....
23	1·6	44	1·35	23	....	....
24	1·52	36	1·35	23	....	....
25	1·5	34	1·35	23	....	....
26	1·45	30	1·3	20	....	....
27	1·4	26	1·25	17	....	....
28	1·4	26	1·25	17	....	....
29	1·55	39	1·2	14	....	....
30	1·53	37	1·2	14	....	....
31	1·47	32	1·2	14	....	....

BONAPARTE RIVER NEAR ASHCROFT.

Location.—Section 5, township 21, range 24, west 6th Meridian.

Records Available.—June 10 to November 6, 1911; March 25, to December 22, 1912; April 1 to December 31, 1913.

Winter Conditions.—A short and often severe winter with very light snowfall. Ice conditions usually exist during January and February.

Gauge.—Vertical staff gauge. Daily readings by H. Collins during the open season.

Channel.—The channel is about 50 feet in width and is straight for several hundred feet above and below the gauge. The control is good.

Discharge Measurements.—Measurements are made by wading in low water and by the "cable carrier" method in high water. Six well distributed measurements were obtained in 1913.

Accuracy.—The accuracy of the results obtained on this stream is high. The gauge height discharge curve is well defined and gauge readings were carefully taken.

General.—During 1913, the timber rock-fill dam on the Bonaparte river (of the Ashcroft Water, Electric and Improvement Company) failed, and the power plant has since been out of commission.

BONAPARTE RIVER.

The Bonaparte river rises in Bonaparte lake at an elevation of 3,800 feet, and discharges into Thompson river, near Ashcroft, at an elevation of 970 feet. Hat creek and Maiden creek (Graves creek) flow in from the west, and Cache creek and Scottie creek from the east. The drainage area is 2,000 square miles. The water is used for irrigation and for water-power. An attempt was made at the power plant of the Ashcroft Water, Electric and Improvement Company to pump water to the Boston flat by means of power obtained from the river, but owing to the high head to which it was necessary to lift the water, the scheme was not successful, since a large flow of water was required to supply the power.

The Bonaparte flows into the Thompson at Ashcroft, and drains a large watershed lying between the Fraser and the North Thompson. At the head waters of several of its branches there are lakes varying in elevation from 2,000 to 3,000 feet. Of these, Bonaparte lake is the largest, being about 10 miles long and 2 miles wide.

Near Ashcroft the Bonaparte has worn a canyon and flows through it for 3 miles or so. The power-house which formerly supplied Ashcroft with power and light is situated near the upper end of this canyon. There are other sites in the canyon, but it is doubtful if there will be much more power development on the stream because of the demand for water for irrigation. This power plant was out of commission in 1913, from a washout which took place in the spring.

Below the canyon there is some good land. The bottom land is being cultivated and irrigated, but the higher benches are arid. About 6 miles from the mouth of the river the valley widens out, and for 15 miles there is a fine stretch of good country. The Cariboo road runs up the valley, and a good deal of the land was taken up in the early days of the province. Even now it is the traffic on this road to Fort George and the northern interior that is the largest factor in the prosperity of the Bonaparte valley. The passengers are carried by automobiles, and make the run through to the boat landing at Soda creek on the Upper Fraser in one day. But the freighting is still done entirely by horses and wagons. These outfits travel about 20 miles a day, and furnish a good market for hay and oats.

The Bonaparte valley is in the dry belt. During the growing season there is almost continuous sunshine, with very little rain (8 or 10 inches). As a consequence nothing will grow without irrigation. But the soil is naturally rich, and when water is supplied, the growth is rapid. At present most of the lower land in the Bonaparte and tributary valleys is under cultivation, and the water supply is about sufficient under the present methods of irrigation. There is much good land on the higher benches and in the Semlin valley and Boston flat which could be irrigated by a long flume from the Bonaparte river. There is sufficient water in the river if the storage on the lakes is utilized, and by constructing one system to serve all, the price per acre would not be excessive. Potatoes do exceptionally well on this land, and Ashcroft potatoes have quite a reputation and bring the highest prices. In the summer, large herds of cattle feed on the good pasturage back on the hills, but they must be fed during the winter, and this makes good market for hay, so that even now the Ashcroft district is a good farming country, and could be made much better by an extensive irrigation system.

Twenty miles from the mouth, the wagon road leaves the Bonaparte valley and climbs to the plateau. This is quite near the boundary of the Railway Belt, so that the best part of the valley is inside this belt. North of the boundary the altitude is higher, the precipitation somewhat heavier, and there is more timber. It is in this part of the watershed that all the lakes lie. There is splendid fishing in many of them, and Indians go up there every fall in large numbers to catch fish for the winter. The Cariboo road does not touch the main stream outside the Railway Belt, and the only means of travelling is by pack trains.

The gauging station on the Bonaparte is at Mr. J. G. Collin's ranch, about 6 miles from the mouth of the stream. It is above the Ashcroft power-house and not far from the upper end of the canyon. The gauge is a five-foot vertical staff nailed to some small trees on the right bank of the stream at Collin's house. It is referred to three bench-marks so that any change of elevation can be detected and corrected. The meter measurements are made at a section about 100 feet above the gauge, where a wire has been stretched across the stream. At high water a carrier is put on this wire and the meter suspended from it by a cable. At low and medium stages the measurements are made at the same section by wading. The channel above the section is straight for 100 feet, and the water is swift. Below the section the channel is straight for 150 feet, and the water swift, though obstructed by one or two boulders. The right bank is 2 feet high, with a fringe of bushes and small trees, at very high stages the water might rise into the bushes. The left bank is 4 feet high and covered with bushes and trees. There could be only one channel even at high water. The bed of the stream is rocky and the water about 2 feet deep at ordinary stages. At the highest stages it is impossible to wade it. At very low water it might be necessary to remove a few shovelfuls of mud to keep open the communication between the little pool in which the gauge is placed and the main stream. At ordinary stages the gauge is in the main stream itself.

Discharge Measurements of Bonaparte River at Collin's Ranch, for 1913

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
April 25	Chisholm & Cline	1,055	54	153·4	4·35	2·96	[1]667
May 3	do do	1,055	48	114	3·63	2·30	415
May 19	K. G. Chisholm	1,055	54	154	4·30	2·81	664
May 27	do	1,055	54	160	4·65	2·99	745
July 31	do	1,055	45	81	2·87	1·76	[2]233
Oct. 3	do	1,055	37	51	1·67	1·09	85

Note.—[1] Cable measurement.
[2] Wading measurement.

Monthly Discharge of Bonaparte River at Collin's Ranch for 1913.

(Drainage area, 2,000 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
April	885	124	408	0·20	0·22	24,278
May	680	340	553	0·28	0·32	34,003
June	655	340	486	0·24	0·27	28,919
July	540	230	399	0·20	0·23	24,534
August	245	145	184	0·09	0·10	11,314
September	145	80	104	0·05	0·06	6,188
October	124	72	106	0·05	0·06	6,518
November	115	80	100	0·05	0·06	5,950
December	105	72	86	0·04	0·05	5,288

Daily Gauge Heights and Discharges of Bonaparte River 5 miles from mouth for 1913.

Day.	March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	....	1·3	124	2·4	455	2·85	655
2	....	....	1·3	124	2·35	435	2·85	655
3	....	....	1·3	124	2·3	415	2·8	630
4	....	....	1·3	124	2·25	397	2·8	630
5	....	....	1·3	124	2·2	380	2·75	607
6	....	....	1·3	124	2·15	360	2·75	607
7	....	....	1·3	124	2·1	340	2·7	585
8	....	....	1·35	135	2·15	360	2·65	562
9	....	....	1·35	135	2·3	415	2·6	540
10	....	....	1·4	145	2·5	495	2·5	495
11	....	....	2·15	360	2·5	495	2·45	475
12	....	....	2·05	325	2·55	517	2·4	455
13	....	....	1·85	260	2·6	540	2·4	455
14	....	....	1·9	275	2·6	540	2·35	435
15	....	....	1·9	275	2·7	585	2·3	415
16	....	....	2·1	340	2·65	562	2·25	397
17	....	....	2·45	475	2·65	562	2·2	380
18	....	....	2·6	540	2·75	607	2·1	340
19	....	....	2·8	630	2·75	607	2·1	340
20	....	....	2·9	680	2·8	630	2·2	380
21	....	....	3·1	780	2·8	630	2·25	397
22	....	....	3·3	885	2·8	630	2·2	380
23	....	....	3·2	830	2·9	680	2·2	380
24	....	....	3·1	780	2·9	680	2·2	380
25	....	....	3·0	730	2·9	680	2·2	380
26	....	....	2·9	680	2·9	680	2·3	415
27	....	....	2·75	607	3·0	730	2·6	540
28	....	....	2·65	562	3·0	730	2·6	540
29	....	....	2·5	495	2·9	680	2·7	585
30	1·25	1·14	2·4	455	2·9	680	2·6	540
31	1·25	1·14	....	....	2·85	655	.....	...

Daily Gauge Heights and Discharges of Bonaparte River 5 miles from mouth for 1913—*Concluded.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	2·6	540	1·7	215	1·4	145	1·05	80	1·2	105	1·2	105
2	2·5	495	1·65	202	1·35	135	1·0	72	1·2	105	1·15	96
3	2·6	540	1·6	190	1·35	135	1·05	80	1·2	105	1·15	96
4	2·55	517	1·6	190	1·3	124	1·1	87	1·2	105	1·1	87
5	2·5	495	1·6	190	1·3	124	1·1	87	1·25	115	1·1	87
6	2·45	475	1·55	178	1·3	124	1·1	87	1·25	115	1·1	87
7	2·45	475	1·55	178	1·25	115	1·1	87	1·25	115	1·1	87
8	2·4	455	1·55	178	1·25	115	1·1	87	1·25	115	1·1	87
9	2·4	455	1·5	166	1·25	115	1·15	96	1·2	105	1·1	87
10	2·35	435	1·5	166	1·2	105	1·15	96	1·2	105	1·1	87
11	2·3	415	1·5	166	1·2	105	1·15	96	1·2	105	1·05	79
12	2·25	387	1·5	166	1·2	105	1·2	105	1·2	105	1·05	79
13	2·3	415	1·55	178	1·2	105	1·2	105	1·15	96	1·1	87
14	2·35	435	1·58	178	1·2	105	1·2	105	1·15	96	1·1	87
15	2·45	475	1·5	166	1·2	105	1·25	115	1·15	96	1·1	87
16	2·5	495	1·5	166	1·2	105	1·25	115	1·25	115	1·1	87
17	2·4	455	1·55	178	1·15	96	1·3	124	1·25	115	1·1	87
18	2·35	435	1·6	190	1·15	96	1·3	124	1·15	96	1·1	87
19	2·3	415	1·65	202	1·1	87	1·3	124	1·1	87	1·1	87
20	2·3	415	1·7	215	1·1	87	1·3	124	1·07	82	1·1	87
21	2·2	380	1·8	245	1·15	96	1·3	124	1·05	80	1·1	87
22	2·15	360	1·8	245	1·15	96	1·3	124	1·05	80	1·1	87
23	2·1	340	1·7	215	1·15	96	1·3	124	1·1	87	1·1	87
24	2·0	310	1·6	190	1·15	96	1·3	124	1·15	96	1·05	79
25	1·95	292	1·55	178	1·1	87	1·3	124	1·1	87	1·2	105
26	1·85	260	1·55	178	1·1	87	1·25	115	1·1	87	1·15	96
27	1·8	245	1·5	166	1·1	87	1·25	115	1·05	79	1·02	75
28	1·8	245	1·5	166	1·1	87	1·25	115	1·1	87	1·0	72
29	1·75	230	1·45	155	1·05	80	1·25	115	1·2	105	1·0	72
30	1·75	230	1·45	155	1·05	80	1·25	115	1·25	115	1·0	72
31	1·75	230	1·4	145	....	....	1·2	105	....	....	1·0	72

CAMPBELL CREEK.

Location.—Section 22, township 19, range 16, west 6th meridian.

Records Available.—May 27 to October 4, 1911; April 1 to September 16, 1912; May 1 to August 31, 1913.

Winter Conditions.—Creek is usually frozen up during December, January, and February and there is little or no run-off in November and March.

Gauge.—Vertical staff gauge read daily by A. Holt.

Channel.—The channel is about 15 feet wide at the gauge. Flow varies from zero to a maximum of 48 second-feet (recorded on May 28, 1912).

Discharge Measurements.—The curve for 1913 is poorly defined, having only three meterings. A shifting channel at the gauge section was a source of considerable trouble.

Accuracy.—The returns for 1911 and 1912 are of high accuracy, but results for 1913 are poor, and very little reliance can be placed upon them. They are probably within 20 per cent of the truth.

CAMPBELL CREEK.

The right branch of Campbell creek rises in the Campbell meadows at an elevation of 2,200 feet: the stream discharges into the South Thompson at an elevation of 1,140 feet. Campbell creek is in the eastern portion of the dry belt, the annual precipitation at the mouth being from 8 inches to 10 inches, and at the headwaters from 12 inches to 15 inches. Campbell creek is a very contentious irrigation stream. The Hydrographic survey has two stations on it, one at Todd's Corners and the other at the Campbell Estate at the mouth. The latter for the purpose of making a study of seepage loss. A slight decrease in discharge is found between the two stations, a portion of the flow of Campbell creek joining the Thompson river as underground water.

The upper reaches of the creek are well timbered with British Columbia fir, jack pine and spruce, and there are large lakes at the head of Campbell creek proper. These lakes are Trapp, Shumway, and Napier. Their superficial area is large, and evaporation in this dry country is great. In the season of 1911 the run-off from these lakes was nil, all Campbell creek water coming down Scuittoe creek (the right branch of Campbell creek) from the Campbell meadows. The lakes are unreliable for storage purposes.

The Campbell estate holds the prior records on this stream, and controls practically the whole flow of Campbell creek.

The Campbell estate has constructed a small dam on Campbell meadows, where water is stored and is used in the late summer for irrigation.

At the height of the irrigation season (June 7) the two diversions above the station at Todd's Corners were carrying 4.5 second-feet; at no time did they exceed this amount, which is about their mean flow for the irrigation season.

The daily flow of Campbell creek, especially in the late summer, is not the true normal discharge of the stream but depends upon the artificial control of the storage reservoir.

The station at Todd's Corners was established on May 27, 1911, by C. E. Richardson, and daily gauge readings were taken during the irrigation seasons of 1911, 1912 and 1913. It is located at the highway bridge on the Kamloops-Grand Prairie road.

The gauge is a 5-foot standard vertical staff gauge, and is in a pool at the right side of the stream just below the bridge. In high water, measurements of the flow are made from the bridge, and in low water, by wading below the bridge. The Creek runs through a meadow but the banks are well defined and there is no danger of overflow.

The station at the Campbell estate is at the mouth of a canyon one quarter of a mile above the Kamloops-Ducks highway. The gauge is a standard vertical staff securely wedged in the rocks at the right bank of the stream.

Measurements are made by wading, the channel being well confined in high rocky banks, and the bed being very rough and rocky. Three bench-marks are located at each station and referred to the gauge datum.

Gauge readings were taken at this station from May 25 to September 20, 1911, and from May 10 to September 1, 1912.

Discharge Measurements of Campbell Creek, near Todd's Corners, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq.-ft.	Ft. per sec.	Feet.	Sec.-ft.
May 3	H. J. E. Keys	1,057	4	1·7	5·8	1·03	9·65
May 3	do	1,057	4	1·6	5·7	1·03	9·16
May 29	do	1,057	16	1·49	1·5	1·68	22·4

Note.—Gauge Reader—A. Holt.

Monthly Discharge of Campbell Creek near Todd's Corners for 1913.

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean Per square mile.	Mean.	Depth in inches on Drainage area.	Total in acre-feet.
May	23·7	6·8	10·6	·05	·06	652
June	24·8	10·2	15·9	·08	·09	946
July	13·9	8·2	10·3	·05	·06	633
August	8·8	5·5	6·9	·03	·03	424

Note.—There are some diversions for irrigation in the upper watershed not included in these figures.

Daily Gauge Heights and Discharges of Campbell Creek near Todd's Corners for 1913.

Date.	May		June.		July.		August.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	0·85	7·1	1·74	24·0	1·20	11·7	0·9	7·6
2	0·86	7·2	1·73	23·7	1·20	11·7	1·0	8·8
3	0·95	8·1	1·77	24·8	1·20	11·7	1·0	8·8
4	1·16	11·1	1·65	21·4	1·20	11·7	1·0	8·8
5	1·13	10·6	1·51	17·9	1·20	11·7	1·0	8·8
6	1·05	9·5	1·47	17·0	1·20	11·7	0·9	7·6
7	0·98	8·6	1·42	15·9	1·15	11·0	0·87	7·3
8	1·00	8·8	1·30	13·5	1·10	10·2	1·0	8·8
9	1·00	8·8	1·50	17·7	1·02	9·1	0·97	8·4
10	1·02	9·1	1·48	17·3	0·95	8·2	0·92	7·8
11	1·05	9·5	1·57	19·4	1·02	9·1	0·86	7·2
12	1·05	9·5	1·52	18·2	1·15	11·0	0·85	7·1
13	1·05	9·5	1·50	17·7	1·25	12·6	0·85	7·1
14	0·98	8·6	1·47	17·0	1·30	13·5	0·82	6·8
15	0·95	8·2	1·45	16·6	1·32	13·9	0·82	6·8
16	0·92	7·8	1·50	17·7	1·20	11·7	0·82	6·8
17	0·92	7·8	1·45	16·6	0·98	8·6	0·80	6·6
18	0·90	7·6	1·45	16·6	0·96	8·3	0·80	6·6
19	0·87	7·3	1·45	16·6	1·00	8·8	0·77	6·4
20	0·85	7·1	1·50	17·7	1·00	8·8	0·77	6·4
21	0·92	6·8	1·30	13·5	1·05	9·5	0·75	6·2
22	0·87	7·3	1·20	11·7	1·10	10·2	0·75	6·2
23	1·05	9·5	1·12	10·5	1·10	10·2	0·72	6·0
24	1·17	11·2	1·15	11·0	1·10	10·2	0·72	6·0
25	1·26	12·8	1·17	11·2	1·10	10·2	0·72	6·0
26	1·25	12·6	1·15	11·0	1·08	9·9	0·72	6·0
27	1·32	13·9	1·10	10·2	1·02	9·1	0·72	6·0
28	1·41	15·7	1·10	10·2	1·00	8·8	0·72	6·0
29	1·53	18·4	1·10	10·2	1·00	8·8	0·67	5·6
30	1·72	23·4	1·15	11·0	1·00	8·8	0·65	5·5
31	1·73	23·7	....	....	0·96	8·3	0·65	5·5

CHERRY CREEK.

Location.—Section 34, township 19, range 19, west 6th, meridian.

Records Available.—June 5 to September 1, 1911; April 24 to September 15, 1912; April 19 to October 19, 1913.

Winter Conditions.—Stream is generally dry during October, November, December, January, and February. Winter conditions are not usually very severe.

Gauge.—Vertical staff gauge read daily by Henry Cornwall.

Channel.—The channel is about 10 feet wide. The maximum recorded flow was 200 section-feet, caused by the failure of a dam on Chuhwhels lake. The normal maximum is uncertain owing to the fact that the flow is artificially controlled.

Discharge Measurements.—It has been necessary to make numerous meterings, as continuous trouble has been met on account of the constant shifting of the stream-bed and washing out of gauges.

Accuracy.—The accuracy of results appended, on account of conditions mentioned above, is low. Returns, especially during high water, may be in error to 20 per cent.

CHERRY CREEK.

Cherry creek has its source in the hills south of Kamloops lake, at an elevation of 3,800 feet, and discharges into Kamloops lake, at an elevation of 1,120 feet. It is part of the Thompson drainage; the drainage area, as measured

from the Geological Survey map, dated 1895, scale 2 miles to 1 inch, is 70 square miles; of this area 33 square miles is above the gauge. Cherry creek has the following tributaries: Alkali creek, entering from the left, Dairy and Pendleton creek from the right, going upstream. Cherry creek, as well as its tributaries, is situated in the most arid section of the dry belt; the summers are hot and dry, the winters long and cold (-20° F.): the precipitation varies from 8 inches, near the mouth, to 12 inches at the headwaters.

Cherry creek is a contentious irrigation stream about 12 miles long. The upper 6 miles consists of dry range hills, with little irrigable land, but the lower half of the stream flows through wide benches, which only required water to become fertile agricultural lands. In a wet season like 1912, the creek will run for six or seven months at the station; in a dry season the stream cannot be depended on for more than three months. and then for a mean discharge of only 2 second-feet. In different sections of the stream conditions vary; near the mouth the creek runs all year; in other places the stream will be absolutely dry, while running a hundred yards above and below. Apparently there is a large amount of seepage in proportion to the size of the stream and this fact makes the measurement of the discharge very difficult. Cherry creek has excellent storage facilities in the following lakes: Big Meadow reservoir with a capacity of 1,250 acre-feet; Chuhwhels lake with a capacity of 525 acre-feet; Roper lake with a capacity of 525 acre-feet; Andrew lake and Cornwall lake, which have not been dammed as yet. These lakes, however, are so far upstream that their catchment basins are small, and only a little water can be conserved, the reservoirs rarely filling to their capacity. Cherry creek is greatly over-recorded; the many records on the creek call for over 4,400 miners inches, or over 120 second-feet, while the mean flow of recent years has been less than 10 second-feet during the whole irrigation season. To further increase the water supply of the Cherry Creek district, records were taken out by Cherry creek interests to divert water from Big Fish and Face lakes, which lakes are part of the Guichon drainage area, flowing southerly into the Nicola district. It is proposed to divert the water of these lakes across the divide and in a northerly direction of the Beaton and Cherry Creek estates: (for further information see remarks on Greenstone creek.) On May 15, 1912, during the freshet, the storage dam on Chuhwhels lake failed and washed out the gauge and the channel, too, was entirely altered. The dam was rebuilt in the summer of 1914.

The river station on Cherry creek was established June 5, 1911, by W. M. Carlyle. The measuring section is located above all diversions on the Kensington ranch, just beside the gauge. The gauge is fastened about 100 feet above the Cornwall diversion on the right bank. The gauge was washed out by the above mentioned dam failure, and a temporary one was located to complete the year 1912. All the measurements are made by wading; this would make an excellent measuring section, but for the possibility of seepage. The control is good, the current uniform, the banks high, and there is only one channel. The datum of the gauge is referred to three bench-marks.

Discharge Measurements of Cherry Creek at Kensington Ranch, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq.-ft.	Ft. per sec.	Feet.	Sec.-ft.
May 1	H. J. E. Keys	1,057	7·0	2·9	2·1	0·33	[1]6·2
June 2	do	1,057	8·0	4·1	2·7	0·52	10·9
June 12	do	1,057	6·0	2·4	1·5	0·4	3·5
July 17	do	1,057	5·0	2·2	2·9	0·07	[1]6·3
Aug. 6	do	1,057	4·5	2·4	4·9	0·02	[2]11·7
Sept. 4	do	1,057	......	......	......	0·36	[3]·5

Note.—[1]New Gauge.
[2]Different section.
[3]Estimated.
Gauge Reader-Henry Cornwall.
Stream bed shifted in freshets and new gauges had to be installed and new rating tables constructed.

Monthly Discharge of Cherry Creek at Kensington Ranch for 1913.

(Drainage aiea 33 square miles).

Month.	Discharge in Second-Feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May	34	4·0	18·7	0·57	0·66	1,150
June	46	0·2	7·5	0·23	0·26	446
July	41	3·4	20·5	0·62	0·71	1,260
August	30·7	0·6	4·9	0·15	0·17	301
September	0·6	0·3	0·5	0·02	0·02	29

Note.—This stream is controlled by dams on the lakes near its source. The station is above all diversions.

DAILY GAUGE HEIGHTS AND DISCHARGES of Cherry Creek at Kensington Ranch for 1913.

DAY.	April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	......	......	1·65	5·6	0·55	13·4
2	......	......	1·65	5·6	0·52	11·1
3	......	......	1·65	5·6	0·5	9·5
4	......	......	1·62	4·6	0·5	9·5
5	......	......	1·62	4·6	0·49	8·9
6	......	......	1·62	4·6	0·49	8·9
7	......	......	1·60	4·0	0·42	4·8
8	......	......	1·67	6·2	0·45	6·6
9	......	......	1·82	12·4	0·42	4·8
10	......	......	2·17	30·2	0·45	6·6
11	......	......	0·8	34·0	0·42	4·8
12	......	......	0·8	34·0	0·40	3·6
13	......	......	0·75	30·5	0·4	3·6
14	......	......	0·72	27·8	0·4	3·6
15	......	......	0·68	24·3	0·35	2·3
16	......	......	0·65	21·6	0·35	2·3
17	......	......	0·6	17·3	0·35	2·3
18	......	......	0·62	19·0	0·34	2·0
19	1·7	7·2	0·62	19·0	0·34	2·0
20	1·8	11·5	0·62	19·0	0·45	3·0
21	1·9	16·0	0·62	19·0	0·45	6·6
22	1·8	11·5	0·62	19·0	0·45	7·1
23	1·75	9·3	0·68	24·3	0·46	7·1
24	1·75	9·3	0·68	24·3	0·55	11·8
25	1·7	7·2	0·72	27·8	0·55	13·4
26	1·7	7·2	0·72	27·8	0·95	46·0
27	1·7	7·2	0·7	26·0	0·60	17·3
28	1·7	7·2	0·68	24·3	0·22	1·7
29	1·7	7·2	0·65	21·6	0·2	0·3
30	1·7	7·2	0·62	19·0	0·15	0·2
31	......	......	0·59	16·5	......	......

Daily Gauge Heights and Discharges of Cherry Creek at Kensington Ranch for 1913.—*Continued.*

Day.	July.		August.		September.		October.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	1·0	50·0	0·1	18·0	0·35	0·6	0·4	0·3
2	0·08	16·6	0·0	10·5	0·35	0·6	0·4	0·3
3	0·05	14·2	0·1	4·7	0·35	0·6	0·4	0·3
4	0·05	14·2	0·25	1·4	0·35	0·6	0·38	0·4
5	0·0	10·5	0·1	4·7	0·35	0·6	0·38	0·3
6	0·07	6·8	0·0	10·5	0·35	0·6	0·4	0·3
7	0·05	14·2	0·0	10·5	0·35	0·6	0·4	0·3
8	0·15	13·4	0·0	10·5	0·35	0·6	0·41	0·3
9	0·15	13·4	0·1	4·7	0·35	0·6	0·41	0·3
10	0·15	13·4	0·1	4·7	0·35	0·6	0·41	0·3
11	0·15	3·4	0·1	4·7	0·35	0·6	0·45	0·2
12	0·15	3·4	0·05	7·6	0·35	0·6	0·45	0·2
13	0·15	3·4	0·2	2·1	0·35	0·6	0·45	0·2
14	0·0	10·5	0·3	0·8	0·35	0·6	0·45	0·2
15	0·03	8·8	0·3	0·8	0·35	0·6	0·45	0·2
16	0·15	22·2	0·3	0·8	0·35	0·6	0·45	0·2
17	0·17	24·8	0·25	1·4	0·37	0·5	0·46	0·1
18	0·13	20·5	0·25	1·4	0·37	0·5	0·46	0·1
19	0·13	20·5	0·25	1·4	0·37	0·5	....	....
20	0·18	24·8	0·3	0·8	0·37	0·5	....	....
21	0·2	26·5	0·3	0·8	0·37	0·5	....	....
22	0·2	26·5	0·32	0·7	0·37	0·5	....	....
23	0·2	26·5	0·32	0·7	0·37	0·5	....	....
24	0·28	32·5	0·32	0·7	0·37	0·5	....	....
25	0·28	32·5	0·13	2·9	0·38	0·4	....	....
26	0·3	35·0	0·0	10·5	0·38	0·4	....	....
27	0·3	35·0	0·25	30·7	0·4	0·3	....	....
28	0·38	41·0	0·32	0·7	0·4	0·3	....	....
29	0·35	39·2	0·35	0·6	0·4	0·3	....	....
30	0·35	39·2	0·35	0·6	0·4	0·3	....	....
31	0·15	22·2	0·35	0·6	....	....	....	....

COLDWATER RIVER AT MERRITT.

Location.—The station is located at Merritt, B. C., on the Nicola Valley branch of the Canadian Pacific Railway. It is about half a mile above the stream's confluence with the Nicola river.

Records Available.—April 17 to August 31, 1913.

Winter Conditions.—There is some severely cold weather during the winter months, and the stream is said to be usually frozen over in January and February.

Gauge.—Gauge is a vertical staff gauge, and was read during 1913 by D. McNeill. John Skimming is gauge reader for 1914.

Channel.—The stream is 50 to 75 feet in width, and its bed is stony. Velocities vary from 0·8 to 5·0 feet per second. During 1913 the maximum flow was 2,650 second-feet, while the minimum recorded flow was 40 second-feet.

Discharge Measurements.—Meterings are made by wading, during low stages, and by cable suspension from the upstream side of the traffic bridge at high water. The gauge-height-discharge curve is not well defined at present, but an effort will be made to have the stream well rated during 1914

Accuracy.—Accuracy of results as shown cannot be vouched for. They are probably within 15 per cent of the truth.

General.—The Coldwater river (according to the Dominion sectional maps) has a drainage area of about 360 square miles. Rising in the Anderson River

hills (near the source of the stream of that name tributary to the Fraser) at an elevation of 6,000 feet, it flows northeast for a distance of 35 miles, joining the Nicola at the town of Merritt. The gauge was established by P. De Lautour on April 17, 1913. The waters of the Coldwater are utilized to some extent for irrigation, but there is no possibility of contention from this source. Their only probable use is as a source of water-power.

Discharge Measurements of Coldwater River near Mouth, 1913

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
April 17	P. DeLautour	....	66	98	....	0·25	243
" 29	do	....	67	127	....	0·50	396
May 2	do	....	66	106	....	0·30	307
" 10	do	....	73	187	....	1·60	1,130
" 14	H. J. E. Keys	1,057	65	202	5·0	1·23	1,010
" 16	do	1,057	63	160	5·2	1·05	836
" 26	do	1,057	71	281	6·6	2·35	1,850
" 27	P. DeLautour	....	80	304	....	2·50	1,980
June 3	do	....	125	337	....	3·35	2,390
July 29	H. J. E. Keys	1,057	60	94	1·3	0·15	122
Aug. 20	do	1,057	59	72	0·8	0·2	56

Monthly Discharge of Coldwater River at Mouth for 1913.

(Drainage area, 360 square miles.)

Month.	Discharge in Second-Feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May	2,180	260	1,074	2·97	3·42	66,040
June	2,650	1,040	1,511	4·20	4·69	89,910
July	1,040	150	437	1·21	1·39	26,870
August	135	40	52	0·14	1·16	3,197

Note.—Gauge reader, D. McNeill.

Daily Gauge Heights and Discharges of Coldwater River at Mouth for 1913.

Day.	April.		May.		June.		July.		August.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	....	....	300	2·7	2,140	1·3	1,040	....	135
2	....	....	0·3	260	2·9	2,300	1·0	800	....	120
3	....	....	....	260	3·35	2,650	0·9	720	....	105
4	....	....	....	260	3·1	2,460	0·8	650	....	90
5	....	....	....	260	2·5	1,980	0·7	570	....	80
6	....	....	0·3	260	2·1	1,670	0·9	720	....	70
7	....	....	0·55	450	2·2	1,750	1·05	840	....	55
8	....	....	1·65	1,320	2·2	1,750	0·9	720	−0·3	40
9	....	....	1·15	920	2·3	1,830	0·7	570	−0·3	40
10	....	....	1·6	1,280	2·2	1,750	0·7	570	−0·3	40
11	....	....	1·5	1,200	2·2	1,750	0·7	570	−0·3	40
12	....	....	1·45	1,160	2·0	1,590	0·6	490	−0·3	40
13	....	....	1·3	1,040	2·1	1,670	0·5	410	−0·3	40
14	....	....	1·25	1,000	1·9	1,520	0·5	410	−0·3	40
15	....	....	1·2	960	1·5	1,200	0·4	330	−0·3	40
16	....	....	1·0	800	1·4	1,120	0·4	330	−0·3	40
17	0·25	220	1·3	1,040	1·35	1,080	0·4	330	−0·3	40
18	....	....	1·1	880	1·25	1,000	0·4	330	−0·3	40
19	....	....	1·1	880	1·55	1,240	0·4	330	−0·3	40
20	....	....	1·2	960	2·1	1,670	....	345	−0·3	40
21	....	....	1·25	1,000	1·5	1,200	....	300	−0·3	40
22	....	....	1·75	1,400	1·5	1,200	....	285	−0·3	40
23	....	....	1·85	1,480	1·5	1,200	....	270	−0·3	40
24	....	....	2·3	1,830	1·5	1,200	....	255	....	40
25	....	....	2·5	1,980	1·3	1,040	....	240	....	40
26	....	....	2·3	1,830	1·4	1,120	....	225	....	40
27	....	....	2·5	1,980	1·4	1,120	....	210	....	40
28	....	....	2·3	1,830	1·3	1,040	....	195	....	40
29	0·5	410	2·15	1,710	1·3	1,040	....	180	....	40
30	....	380	2·0	1,590	1·3	1,040	....	165	....	40
31	....	340	2·75	2,180	....	....	....	150	....	40

CRISS CREEK NEAR SAVONA.

Location.—Section 22, township 22, range 22, west 6th meridian.

Records Available.—June 14, 1912 to September 14, 1912; April 22, 1913, to November 21, 1913.

Winter Conditions.—Very little snow during the winter with only short periods of severe weather. Conditions essentially the same as in the Deadman valley.

Gauge.—Staff gauge read daily during the irrigation season by W. J. Hoey.

Channel.—The stream is well confined to a single channel, whose bed is of gravel and boulders.

Discharge Measurements.—Nine well distributed measurements have been obtained and the gauge-height-discharge curve is well defined for any flow up to 250 second-feet. Above this point, however, it has been necessary to project results, and an endeavour to ratify them will be made during 1914.

Accuracy.—The accuracy is high except during the freshet flow, when results cannot be vouched for.

CRISS CREEK.

Criss creek has its source in the hills between the headwaters of Deadman river and Tranquille river, at an elevation of about 6,000 feet. After a south-westerly course of about 25 miles it discharges into the Deadman river 10 miles above mouth, at an elevation of about 1,500 feet.

It is part of the Thompson River drainage and its drainage area, as measured from a Geological Survey map, dated 1895, is 150 square miles.

In the lower part of its source the creek flows swiftly through a narrow valley with steep sides and many sheer cliffs. In its upper reaches there is said to be considerable land suitable for homesteading. A number of homesteaders went in during the summer of 1913.

A rough pack trail leads up the creek from the mouth, and a road, which branches off from the Deadman river road about 15 miles from the mouth of Criss creek, strikes the creek again about 10 miles from its mouth.

The timber in the valley is of small size. There are several small lakes at the headwaters. The gauging station was established on June 14, 1912, by C. G. Cline. A vertical staff gauge is fastened to a large fir on the right bank of the stream, some 400 yards above the highway bridge. At low water, measurements are made by wading near the gauge, and at high water by cable suspension from the highway bridge.

Discharge Measurements of Criss Creek near Savona, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
1912.							
June 14	C. Cline & Corbould		21	47·6	2·2	1·09	107
July 16	B. Corbould		245	31·4	1·2	0·7	38
Aug. 5	do		24	28·6	1·15	0·62	33
" 30	do		22	29·2	1·04	0·6	30
1913.							
April 22	C. Cline & Chisholm		30	114·0	1·9	1·62	217·0
May 17	K. G. Chisholm		30	123·6	2·03	1·72	251·0
June 10	do		30	99·95	1·72	1·49	176·00
Aug. 15	do		18	26·94	1·15	0·53	31·05
Oct. 4	do		13	13·4	0·91	0·18	12·1

Note.—Gauge reader, W. J. Hoey.

Monthly Discharge of Criss Creek at Mouth for 1913.

(Drainage area, 150 square miles.)

Month.	Discharge in Second-Feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May	444	68	860	1·73	1·99	15,986
June	340	76	167	1·11	1·24	9,937
July	418	41	169	1·13	1·30	10,391
August	85	13	32	0·21	0·24	1,968
September	14	8	12	0·08	0·09	714
October	68	10	31	0·21	0·24	1,906
November	26	20	24	0·16	0·18	1,428

Note.—Gauge reader, W. J. Hoey.

DAILY GAUGE HEIGHTS AND DISCHARGES of Criss Creek near Mouth for 1913.

Day.	April.		May.		June.	
	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	......	......	1·0	85	2·1	340
2	......	......	1·1	103	2·0	314
3	......	......	1·2	122	1·9	288
4	......	......	1·1	103	1·8	262
5	......	......	1·0	85	1·7	238
6	......	......	0·9	68	1·6	213
7	......	......	1·1	103	1·5	189
8	......	......	1·2	122	1·5	189
9	......	......	1·9	288	1·4	165
10	......	......	2·5	444	1·5	189
11	......	......	2·3	391	1·5	189
12	......	......	2·2	366	1·55	201
13	......	......	2·1	340	1·5	189
14	......	......	2·0	314	1·4	165
15	......	......	2·0	314	1·4	165
16	......	......	1·7	238	1·3	143
17	......	......	1·7	238	1·2	122
18	......	......	1·8	262	1·1	103
19	......	......	1·8	262	1·0	85
20	......	......	1·85	275	1·0	85
21	......	......	1·85	275	1·0	85
22	1·65	225	1·90	288	1·0	85
23	1·5	189	1·90	288	0·95	76
24	1·4	165	1·95	301	0·95	76
25	1·4	165	2·0	314	1·0	85
26	1·4	165	2·0	314	1·3	143
27	1·3	143	2·05	327	1·3	143
28	1·3	143	2·2	366	1·4	165
29	1·2	122	2·2	366	1·4	165
30	1·1	103	2·1	340	1·3	143
31	1·0	85	2·2	366	......	......

Daily Gauge Heights and Discharges of Criss Creek near Mouth for 1913.

Day.	July.		August.		September.		October.		November.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	1·3	143	1·0	85	0·25	14	0·1	10	0·4	20
2	1·2	122	0·9	68	0·25	14	0·1	10	0·4	20
3	1·1	103	0·8	53	0·2	13	0·15	11	0·4	20
4	1·0	85	0·8	53	0·2	13	0·2	13	0·4	20
5	1·2	122	0·7	41	0·2	13	0·2	13	0·4	20
6	1·1	103	0·5	26	0·2	13	0·2	13	0·45	23
7	1·0	85	0·4	20	0·15	11	0·3	16	0·5	26
8	0·95	76	0·3	16	0·15	11	0·3	16	0·5	26
9	0·9	68	0·2	13	0·15	11	0·4	20	0·5	26
10	0·8	53	0·25	15	0·1	10	0·4	20	0·5	26
11	0·7	41	0·3	16	0·1	10	0·5	26	0·5	26
12	0·7	41	0·4	20	0·1	10	0·6	32	0·5	26
13	0·8	53	0·5	26	0·05	8	0·7	41	0·5	26
14	0·9	68	0·5	26	0·05	8	0·8	53	0·5	26
15	2·3	391	0·5	26	0·1	10	0·9	68	0·5	26
16	2·4	418	0·5	26	0·1	10	0·9	68	0·5	26
17	2·3	391	0·5	26	0·1	10	0·8	53	0·5	26
18	2·3	391	0·5	26	0·15	11	0·75	47	0·5	26
19	2·2	366	0·6	32	0·15	11	0·75	47	0·5	26
20	1·9	288	0·7	41	0·2	13	0·75	47	0·5	26
21	1·8	262	0·85	60	0·2	13	0·75	47	0·5	26
22	1·7	238	0·8	53	0·2	13	0·65	36	....	....
23	1·6	213	0·8	53	0·25	14	0·65	36	....	....
24	1·5	189	0·7	41	0·25	14	0·65	36	....	....
25	1·5	189	0·6	32	0·2	13	0·6	32	....	....
26	1·4	165	0·5	26	0·2	13	0·6	32	....	....
27	1·3	143	0·4	20	0·2	13	0·5	26	....	....
28	1·2	122	0·3	16	0·15	11	0·5	26	....	....
29	1·1	103	0·25	14	0·15	11	0·4	20	....	....
30	1·1	103	0·25	14	0·10	10	0·4	20	....	....
31	1·0	85	0·2	13	....	....	0·4	20	....	....

DEADMAN RIVER NEAR SAVONA.

Location of Station.—Section 22, township 22, range 22, west 6th meridian, half a mile above the mouth of Criss creek. This station was established in 1913 to replace a station below the mouth of Criss creek, upon which information was obtained during the irrigation seasons of 1911 and 1912.

Records Available.—April 22 to November 21, 1913.

Winter Conditions.—Very little snow on the lower benches, with only short periods of severe weather. Six to ten feet of snow in the upper reaches of the creek.

Gauge.—Staff gauge read daily during the irrigation season by W. J. Hoey.

Channel.—Channel is straight and control is good, while the velocity is great only during high stages.

Discharge Measurements.—Six well distributed measurements were obtained during 1913. Although a metering was not secured at the peak of the freshet the flow was deduced by the projection of the discharge curve. During 1914 this deduction will be ratified if possible.

Accuracy.—The accuracy is high except for the short period when flow was above 300 second-feet, which condition is mentioned above.

DEADMAN RIVER.

Deadman creek has its source in numerous small lakes between the headwaters of Tranquille creek and Bonaparte lake, some 20 miles west of the Thompson river. Most of these lakes are yet unnamed, and have an elevation of about 4,000 feet. The creek flows in a westerly direction for about 20

miles, then turns toward the south and, after a course of 30 or 35 miles farther, discharges into the Thompson river just below Kamloops lake, at an elevation of about 1,100 feet.

The chief tributaries are: from the left going upstream Clemes creek, Gorge creek, Tobacco creek, and Hunters creek. From the right, Criss creek, and Last Chance creek. The total drainage area from the Provincial Government map of the Yale district, dated 1912, scale 8 miles to 1 inch, is 500 square miles. The area above Criss creek, viz., above the measuring section, is 400 square miles. The water is used for irrigation only. The Barnes estate at Walhachin take water from Deadman creek. They have a dam on Deadman lake about 20 miles from the mouth of the creek. Their intake is about 10 miles from the mouth, and the water is carried by a 6 by 4-foot wooden flume to Walhachin.

There are several good power sites on the stream, which have not been developed. Just below the confluence of Hunters creek, 30 miles from the mouth there is a fall of 160 feet.

Deadman creek lies in the dry belt, with a precipitation near the mouth of about 10 inches. Like all streams in the dry belt, the precipitation increases toward the upper reaches with the increase in altitude. What is probably the best part of the valley is owned by Indians. They hold everything beyond the Anderson ranch to the Williams ranch, which is about 13 miles from Savona. This portion of the valley is excellent agricultural land, and beyond this for several miles it is narrow and extremely rough, then widens out again and there are stretches of good land, and several fine ranches have been developed.

A station was established just above the intake of the Walhachin flume (12 miles from Savona) on July 11, 1911. Readings were taken on the gauge at this point during the remainder of the irrigation season (1911) and the whole irrigation season (1912). It was replaced, however, in 1913 by a station installed above the confluence of Criss creek, which has been found to give better results, Criss creek itself also having been rated.

During 1911 readings were taken on a gauge 3 miles from the creek's mouth, with a view to finding the amount of water and to studying the question of seepage.

Discharge Measurements of Deadman River above Criss Creek, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913			Feet.	Sq.-ft.	Ft. per sec.	Feet.	Sec.-ft.
April 23......	Cline & Chisholm.............	1,055	30	91·7	3·1	3·60	[1]281
April 22......	K. G. Chisholm & C. G. Cline	1,055	40	72·8	3·5	3·52	[2]256
May 17......	K. G. Chisholm..............	1,055	34	115·0	4·15	3·95	410
June 11......	do	1,055	24·5	32·9	3·00	2·38	[3]98·6
Aug. 15......	do	1,055	15·5	19·4	2·53	1·80	[4]49
Oct. 6......	do	1·055	11·7	9·2	1·11	0·93	[4]10·2

Note.—[1]Measured from bridge.
[2]Measured 50 feet below gauge from bridge.
[3]Gauge wading 50 feet above.
[4]Gauge wading 20 feet above.

Monthly Discharge of Deadman River above Criss Creek, for 1913.

(Drainage area, 400 square miles).

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage	Total in acre-feet.
May	481	145	261	0·65	0·75	16,048
June	156	42	90	0·22	0·24	5,355
July	133	42	92	0·23	0·26	5,657
August	57	11	31	0·08	0·09	1,906
September	11	10	10	0·02	0·02	595
October	12	10	11	0·03	0·03	676
November	14	11	12	0·03	0·03	714
The period	481	10	73	0·18	1·42	30,951

Daily Gauge Heights and Discharges of Deadman River above Criss Creek for 1913.

Day.	April.		May.		June.	
	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1			3·2	199	2·9	156
2			3·1	183	2·8	145
3			3·1	183	2·7	133
4			3·0	169	2·7	133
5			2·9	156	2·6	122
6			2·9	156	2·5	112
7			2·8	145	2·5	112
8			2·8	145	2·5	112
9			2·9	156	2·4	102
10			3·1	183	2·4	102
11			3·3	216	2·3	92
12			3·8	340	2·3	92
13			4·0	434	2·2	82
14			4·1	481	2·2	82
15			4·1	481	2·1	73
16			4·0	434	2·1	73
17			3·95	408	2·0	65
18			3·85	362	2·0	65
19			3·8	340	2·0	65
20			3·7	306	2·0	65
21			3·7	206	1·9	57
22	3·5	254	3·6	278	1·9	57
23	3·5	254	3·6	278	1·8	49
24	3·6	278	3·6	278	1·7	42
25	3·5	254	3·4	234	1·9	57
26	3·5	254	3·4	234	2·1	73
27	3·4	234	3·4	234	2·0	65
28	3·3	216	3·3	216	2·4	102
29	3·3	216	3·2	199	2·4	102
30	3·2	199	3·1	183	2·4	102
31			3·0	169		

DAILY GAUGE HEIGHTS AND DISCHARGES of Deadman River above Criss Creek for 1913—*Continued.*

Day.	July.		August.		September.		October.		November.	
	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	2·4	102	1·7	42	1·0	11	0·9	10	1·0	11
2	2·4	102	1·6	36	1·0	11	0·9	10	1·0	11
3	2·5	112	1·6	36	1·0	11	0·9	10	1·05	12
4	2·4	102	1·6	36	1·0	11	0·9	10	1·0	11
5	2·4	102	1·6	36	1·0	11	0·9	10	1·0	11
6	2·4	102	1·6	36	0·9	10	0·9	10	1·0	11
7	2·3	92	1·6	36	0·9	10	0·9	10	1·0	11
8	2·3	92	1·6	36	0·9	10	0·9	10	1·0	11
9	2·2	82	1·8	49	0·9	10	0·9	10	1·0	11
10	2·2	82	1·7	42	0·9	10	0·9	10	1·0	11
11	2·1	73	1·7	42	0·9	10	1·0	11	1·0	11
12	2·2	82	1·9	57	0·9	10	1·0	11	1·05	12
13	2·2	82	1·8	49	0·9	10	1·05	12	1·1	14
14	2·2	82	1·8	49	1·0	11	1·05	12	1·1	14
15	2·3	92	1·8	49	1·0	11	1·0	11	1·1	14
16	2·5	112	1·8	49	1·0	11	1·0	11	1·1	14
17	2·5	112	1·6	36	0·9	10	1·0	11	1·1	14
18	2·6	122	1·5	30	0·9	10	1·05	12	1·1	14
19	2·6	122	1·4	25	0·8	10	1·05	12	1·1	14
20	2·7	133	1·4	25	0·95	10	1·0	11	1·1	14
21	2·6	122	1·4	25	0·9	10	1·0	11	1·1	14
22	2·5	112	1·3	20	0·9	10	1·0	11	....	....
23	2·4	102	1·3	20	0·9	10	1·0	11	....	....
24	2·3	92	1·3	20	0·9	10	1·0	11	....	....
25	2·3	92	1·2	17	0·9	10	1·0	11	....	....
26	2·2	82	1·2	17	0·9	10	1·0	11	....	....
27	2·0	65	1·1	14	0·95	10	1·0	11	....	....
28	1·9	57	1·1	14	0·95	10	1·0	11	....	....
29	1·9	57	1·0	11	0·95	10	1·0	11	....	....
30	1·8	49	1·0	11	0·95	11	1·0	11	....	....
31	1·7	42	1·0	11	....	....	1·0	11	....	....

DEADMAN RIVER (WALHACHIN FLUME).

Location.—Section 26, township 21, range 22, west 6th meridian.

Records Available.—July 15 to August 31, 1912; April 21 to August 16, 1913.

Gauge.—Gauge is a standard vertical staff gauge, and is read daily by R. McDonald, during the irrigation season.

Flume.—Six-foot timber flume, 4 feet deep, seams caulked with oakum, and the whole interior coated with tar. The flow is even.

Discharge Measurements.—The flume is fairly well rated by four meter measurements practically covering its range.

Accuracy.—Accuracy of results submitted is fairly high, and will be well defined during 1914.

WALHACHIN FLUME.

(Extract from report by P. A. Carson dated August 21, 1911.)

The source of water supply for Barnes estates is Deadman river, a stream 35 feet wide, from 2 to 4 feet deep. It rises in the hills (elevation 6,000 feet) some 40 to 50 miles north of the Thompson river, and flows in a general southerly direction.

The minimum discharge of Deadman river is about 16 second-feet at the end of August, and the maximum about 450 second-feet at the middle of May.

Just outside the northerly limit of the Railway Belt the river widens into a lake, called Snohoosh lake, or Deadman lake. This lake is a narrow winding body of water about 3 miles long, with a superficial area of 350 acres. It affords a good reservoir site, and to store the surplus waters of the spring freshet for the dry summer season, the company have constructed a dam at the outlet of the lake.

The dam is timber cribbed and rock-filled, the timber being lock-bolted together; it is founded on rock bed, and the base is concrete lined, with two 24-inch steel pipes laid in concrete. The dam is 140 feet long and 20·5 feet high, with a width at the base of 56 feet. The spillway is 90 feet wide, having a 3-foot parapet. By means of this dam 7,000 acre-feet of water can be stored. The natural flow of the river is ample for irrigation until July 15, when the stored waters are called upon until close of irrigation season, about August 15. The enormity of the spring flood may be comprehended when I say that after the freshet commenced the reservoir was filled in four days.

A conservative estimate of the duty of water in this locality is 100 acres per second-foot, and with the storage in Snohoosh lake there is sufficient water to irrigate 7,000 acres of land. The Barnes estates are already supplying water to the Savona Orchard Company, on Deadman Indian reserve, and are syphoning 5 second-feet across the Thompson river to the British Columbia Horticultural estates. They will probably also supply water to some ranches along Eight mile creek, adjoining their property on the west, and have constructed their canal with that object in view. Besides the Barnes estates there are several smaller users obtaining their water from Deadman river, and there is plenty for all.

Flumes and Ditches.

The main channel is about 10 miles long from the intake to the easterly boundary of the estate. In this portion there are 7½ miles of flume and 2½ miles of ditch.

The main flume is a 6-foot timber flume, 4 feet deep, and will carry 3 feet of water; it is made of 1¾-inch boards, well seasoned, the sides and bottom

are shiplapped, and the seams caulked with oakum, and the whole interior coated with tar, making a very permanent and watertight construction. The studdings (4 by 4) are alternately capped with cross-pieces to prevent spreading. Such a flume is perhaps not as permanent as a concrete or a steel flume, but is much cheaper, and will last for many years. The maximum grade is 5 feet to the mile, and the velocity is 3·8 feet per second.

The main ditch is slightly larger than the flume, but has the same capacity. The gravelly subsoil through which most of the ditch passes is rather porous, and last year a great deal of trouble was experienced with seepage, something like 40 per cent of the water being lost in transmission. By puddling the water with silt and a little concrete this difficulty has been almost entirely overcome.

However, I believe the greater portion of the ditch will have to be lined with concrete ultimately.

A right of way or easement for the main canal across the Indian reserve has been obtained, and is well fenced.

From the east half of section 10, township 21, range 22, to the east boundary of section 13, township 21, range 23, the main flume is a 4-foot construction similar to the 6-foot flume. It has a maximum capacity of 30 second-feet; the slope is 8 feet to the mile. Note the trestle work in photograph No. 8.

In the canal there are 15,600 feet of flume and 7,000 feet of ditch.

From the east boundary of section 13 to the west limit of the estate, the canal is 3 feet wide. It has a capacity of 18 second-feet, which is larger than is needed by this company, but it is proposed to supply water to some ranches adjoining the west. This flume is not tarred or capped as yet.

In the 3-foot canal there are 10,500 feet of flume and 5,550 feet of ditch.

Of the laterals for distributing the water of the different parts of the estate, there are 46,300 feet of small fluming, and 30,500 feet of small ditching. All the laterals leave the main canal from the flume, not ditch, and in consequence there is little danger of washout.

The distribution system is rather elaborate, and is not described here.

MONTHLY DISCHARGE of Walhachin Flume near Head Gates for 1913.

Month.	Discharge in Second-Feet.			Run-Off.
	Maximum.	Minimum.	Mean.	Total in acre-feet.
April	14·1	0	2·97	177
May	24·1	16·6	22·1	1,359
June	29·1	24·1	27·2	1,618
July	30·9	19·4	27·1	1,666
August	30·9	0	13·7	842

Total amount of water diverted in 1913=5,662 acre-feet.

DISCHARGE MEASUREMENTS of Walhachin flume near Head Gates, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
April 21	K. G. Chisholm	1,055	6·0	3·25	1·6	0·55	5·3

Daily Gauge Heights and Discharges of Walhachin Flume near Head Gates on Deadman River for 1913.

Day.	April.		May.		June.		July.		August.	
	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	....	1·1	16·6	1·35	24·1	1·35	24·1	1·55	30·9
2	....	....	1·1	16·6	1·35	24·1	1·3	22·5	1·5	29·1
3	....	....	1·2	19·4	1·35	24·1	1·3	22·5	1·5	29·1
4	....	....	1·2	19·4	1·35	24·1	1·3	22·5	1·45	27·4
5	....	....	1·2	19·4	1·35	24·1	1·35	24·1	1·4	25·7
6	....	....	1·3	22·5	1·4	25·7	1·35	24·1	1·3	22·5
7	....	....	1·3	22·5	1·4	25·7	1·35	24·1	1·5	29·1
8	....	....	1·3	22·5	1·45	27·4	1·4	25·7	1·5	29·1
9	....	....	1·3	22·5	1·45	27·4	1·4	25·7	1·5	29·1
10	....	....	1·3	22·5	1·45	27·4	1·4	25·7	1·5	29·1
11	....	....	1·3	22·5	1·5	29·1	1·45	27·4	1·4	29·1
12	....	....	1·3	22·5	1·5	29·1	1·45	27·4	1·4	29·1
13	....	....	1·3	22·5	1·5	29·1	1·2	19·4	1·4	29·1
14	....	....	1·3	22·5	1·5	29·1	1·3	22·5	1·4	29·1
15	....	....	1·3	22·5	1·5	29·1	1·4	25·7	1·4	29·1
16	....	....	1·3	22·5	1·45	27·4	1·4	25·7	[1]	[1]
17	....	....	1·3	22·5	1·5	29·1	1·5	29·1		
18	....	....	1·3	22·5	1·5	29·1	1·5	29·1		
19	....	....	1·3	22·5	1·5	29·1	1·55	30·9		
20	....	....	1·3	22·5	1·45	27·4	1·55	30·9		
21	0·55	6·0	1·3	22·5	1·45	27·4	1·55	30·9		
22	0·6	6·8	1·3	22·5	1·45	27·4	1·55	30·9		
23	0·6	6·8	1·3	22·5	1·45	27·4	1·55	30·9		
24	0·6	6·8	1·3	22·5	1·45	27·4	1·55	30·9		
25	0·0	0·0	1·3	22·5	1·45	27·4	1·5	29·1		
26	0·7	8·3	1·35	24·1	1·5	29·1	1·5	29·1		
27	0·9	12·0	1·35	24·1	1·5	29·1	1·5	29·1		
28	1·0	14·1	1·35	24·1	1·5	29·1	1·5	29·1		
29	1·0	14·1	1·35	24·1	1·4	25·7	1·55	30·9		
30	1·0	14·1	1·35	24·1	1·4	25·7	1·55	30·9		
31	....	....	1·35	24·1	....	....	1·5	29·1		

[1] End of irrigation season.

EAGLE RIVER AT MALAKWA.

Location.—In township 23, range 6, west 6th meridian, 15 miles from the mouth, at the traffic bridge near Malakwa, B. C.

Winter Conditions.—Heavy fall of snow, fairly severe weather (—20°F-). The river is generally partially frozen between November 15 and March 15.

Records Available.—May to December, 1913.

Gauge.—Chain gauge is used, and is read daily by Mr. Earl Swan, of Malakwa, B. C.

Channel.—The channel is uniform and straight for 100 yards above and below the gauge. The control has not yet been studied as to permanency.

Discharge Measurements.—Measurements are made from the upstream side of the traffic bridge, six well distributed measurements being made during 1913.

Accuracy.—Accurate gauge readings, careful meter measurements, and the appearance of the gauge-height-discharge curve tend to show that the 1913 data on this stream are very accurate; results, except in May and June, should be within 5 per cent.

General.—This station on Eagle river at Malakwa was established on May 14, 1913, to replace the station established in 1911, near Sicamous, where it was found there was a backwater effect from Shuswap lake during high water.

Discharge Measurements of Eagle River near Malakwa, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
May 14......	C. E. R. & J. A. E...........	1,048	125	674	4·00	4·80	2,690
" 31......	J. A. Elliott..................	1,672	132	1,100	6·46	6·80	7,110
June 7......	do	1,672	132	1,090	6·20	6·70	6,750
July 10......	do	1,672	128	740	4·14	5·12	3,060
Aug. 27......	do	1,672	128	580	2·49	3·70	1,440
Nov. 7......	E. M. D. & K. G. C.........	....	125	468	1·32	2·61	620

Monthly Discharge of Eagle River near Malakwa for 1913.

(Drainage area, 420 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May..	8,150	....	2,860	6·81	7·85	176,000
June..	12,200	3,370	6,444	15·34	17·10	383,000
July..	3,950	1,670	2,861	6·81	7·85	176,000
August..	2,150	1,110	1,739	4·14	4·77	107,000
September.....................................	3,540	690	1,228	2·92	3·26	73,000
October.......................................	1,670	480	804	1·91	2·20	49,400
November......................................	730	300	519	1·24	1·38	30,900
December......................................	480	215	318	0·76	0·88	19,600

Note.—First thirteen days in May are estimated.

DAILY GAUGE HEIGHTS AND DISCHARGES of Eagle River near Malakwa for 1913.

Day.	May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	....	....	8,400
2	....	....	7·5	9,680
3	....	....	7·6	10,100
4	....	....	7·2	8,510
5	....	....	6·8	7,120
6	....	....	6·15	5,140
7	....	....	6·7	6,790
8	....	....	7·45	9,480
9	....	....	7·7	10,500
10	....	....	8·05	12,150
11	....	....	7·45	9,480
12	....	....	7·2	8,510
13	....	....	7·25	8,600
14	4·8	2,650	6·95	7,630
15	4·4	2,150	6·3	5,540
16	4·3	2,040	5·7	4,110
17	4·4	2,150	5·45	3,630
18	4·4	2,150	5·3	3,370
19	4·4	2,150	6·1	5,010
20	4·6	2,390	6·9	7,460
21	4·8	2,650	6·3	5,540
22	5·2	3,210	6·2	5,270
23	5·6	3,910	5·95	4,650
24	5·9	4,540	5·45	3,630
25	6·2	5,270	5·45	3,630
26	6·2	5,270	5·5	3,720
27	6·3	5,540	5·7	4,110
28	6·6	6,460	5·55	3,820
29	7·1	8,150	5·5	3,720
30	6·6	6,460	5·65	4,010
31	6·8	7,120	....	....

DAILY GAUGE HEIGHTS AND DISCHARGES of Eagle River near Malakwa for 1913.

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec. ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	3,950	4·05	1,770	3·05	940	2·6	620	2·6	620	2·4	480
2	....	3,880	4·2	1,930	2·9	830	2·8	760	2·55	600	2·3	420
3	5·55	3,820	4·15	1,880	4·7	2,520	2·6	620	2·55	600	2·2	370
4	5·05	2,990	4·1	1,820	5·4	3,540	2·55	590	2·55	600	2·2	370
5	4·9	2,780	4·1	1,820	4·2	1,930	2·45	520	2·6	620	2·2	370
6	4·9	2,780	4·15	1,880	3·8	1,530	2·5	550	2·7	690	2·2	370
7	5·1	1,060	4·2	1,930	3·55	1,310	2·5	550	2·6	620	2·2	370
8	5·25	3,290	4·3	2,040	3·6	1,350	2·45	520	2·55	590	2·2	370
9	4·95	2,850	4·35	2,100	3·8	1,530	2·4	480	2·55	590	2·2	370
10	5·15	3,140	4·15	1,880	3·6	1,350	2·4	480	2·65	660	2·2	370
11	5·0	2,920	4·1	1,820	3·5	1,270	2·4	480	2·65	660	2·1	330
12	4·9	2,780	3·9	1,620	3·5	1,270	2·7	690	2·65	660	2·1	330
13	5·15	3,140	4·15	1,880	3·5	1,270	3·95	1,670	2·75	730	2·1	330
14	5·2	3,210	4·4	2,150	3·5	1,270	3·3	1,110	2·7	730	2·1	330
15	5·2	3,210	4·3	2,040	3·25	1,080	3·2	1,040	2·5	550	2·1	330
16	5·2	3,210	4·2	1,930	3·25	1,080	3·05	940	2·4	480	2·1	330
17	5·0	2,920	4·1	1,820	3·2	1,040	2·9	830	2·3	420	2·0	300
18	4·85	2,720	4·15	1,880	3·6	1,350	2·85	800	2·3	420	2·0	300
19	5·15	3,140	4·1	1,820	3·35	1,150	2·9	830	2·35	450	1·9	270
20	5·15	3,140	4·1	1,820	3·15	1,000	2·9	830	2·1	330	1·8	250
21	5·0	2,920	4·1	1,820	3·2	1,040	2·8	760	2·0	300	1·8	250
22	5·0	2,920	3·95	1,670	3·2	1,040	2·9	830	2·1	330	1·7	230
23	4·95	2,850	4·1	1,820	3·0	900	2·9	830	2·1	330	1·6	215
24	4·9	2,780	3·95	1,670	2·9	830	3·6	1,350	2·3	420	1·6	215
25	4·65	2,470	3·8	1,530	2·8	760	3·2	1,040	3·2	370	1·6	215
26	4·55	2,330	3·85	1,580	2·8	760	3·2	1,040	2·1	330	2·0	300
27	4·4	2,150	3·7	1,440	2·8	760	3·05	940	2·2	370	2·1	330
28	4·35	2,100	3·4	1,190	2·8	760	3·2	1,040	2·5	550	2·1	330
29	4·2	1,930	3·3	1,110	2·7	690	2·9	830	2·4	480	2·0	300
30	3·95	1,670	3·3	1,110	2·7	690	2·75	730	2·4	480	1·8	250
31	3·95	1,670	3·35	1,150	....	....	2·6	620	....	....	1·8	250

ESSELL CREEK NEAR ADELPHI.

Location.—Section 35, township 17, range 14, west 6th meridian, below Summit Lake tributary to Salmon river.

Records Available.—May 25 to September 30, 1911; April 1 to September 7, 1912; April 16 to September 14, 1913.

Winter Conditions.—Winter conditions are not as a rule severe. The stream is usually dry during the winter months. A storage dam on Summit lake controls its regimen.

Gauge.—A standard vertical staff gauge, read tri-weekly by T. F. Teagle.

Channel.—The channel is gravelly, and there is no possibility of overflow at the gauge. The control is good.

Discharge Measurements.—Well distributed meterings have been made covering the stream's range.

Accuracy.—The accuracy of results appended is fairly high, within 10 per cent.

ESSELL CREEK.

Essell creek, locally known as Summit Lake creek, has its source in Summit lake near the divide between Monte creek and Grand Prairie, at an elevation of 2,050 feet, and discharges into the Salmon river near Grand Prairie, at an elevation of 1,800 feet. Its drainage area is a little over 6 square miles and its natural run-off is very small. A diversion has, however, been made from Monte

creek to Summit lake by a ditch about a mile long, and it is this Monte creek water which provides the greater part of the flow of Essell creek. This water is used around Grand Prairie, where there are over 5,000 acres of land under cultivation. The precipitation in the Essell creek drainage area is from 12 inches to 15 inches, and the evaporation losses from Summit lake are great.

The station was established on May 25, 1911, by C. E. Richardson, and daily gauge readings have been taken during the irrigation seasons of 1911, 1912, and 1913.

The measuring section is 100 yards from highway from Grand Prairie to Ducks, 2 miles from Grand Prairie and 50 yards above the gauge.

The gauge is a vertical staff gauge 5 feet long. Measurements are made with wading equipment from two planks thrown across the stream.

The banks are gently sloping, with no chance of overflow. The bed of the stream is of sand and gravel. Three bench-marks have been placed at the station and their elevations referred to the datum of the gauge.

Discharge Measurements of Essell Creek, near Grand Prairie, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity	Gauge Height	Discharge
1911			Feet	Sq. ft.	Ft. per sec.	Feet	Sec.-ft.
May 25	W. M. Carlyle	1044	10	11·3	1·74	1·30	19·7
" 25	C. E. Richardson	1048	11	14·6	1·71	1·21	16·2
" 25	C. G. Cline	1046	12	12·7	1·28	1·20	16·2
June 5	C. E. Richardson	1048	11	13·6	1·79	1·42	24·5
Aug. 24	W. M. Carlyle	1044	9	3·6	0·73	0·83	2·7
" 24	do	1044	9	3·3	0·74	0·81	2·5
1912.							
May 10	C. E. Richardson	1048	11	15·4	2·12	1·80	32·7
July 15	do	1048	10·5	6·1	1·61	1·22	9·8
" 17	do	1048	10	5·6	1·57	1·18	8·8
Aug. 27	do	1049	9	2·8	0·93	0·98	2·6
Apr. 24	H. J. E. Keys	1057	5	1·8	1·50	1·00	2·7
June 19	do	1057	10	12·5	1·5	1·53	18·9
July 11	do	1057	10	9·2	1·2	1·32	11·2

Monthly Discharge of Essell Creek, near Grand Prairie for 1913.

[Drainage area, 6 square miles.]

Month.	Discharge in Second-Feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May	20	7	10·4	1·73	1·99	640
June	22·8	19	20·6	3·63	4·05	1,225
July	22	3·1	10·2	1·70	1·96	627
August	8·6	4	6·7	1·12	1·29	410

Note.—Artificial control.

Daily Gauge Heights and Discharges of Essell Creek near Grand Prairie for 1913.

Day.	April.		May		June.		July.		August.		September.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	....	....	4·2	....	20·1	1·55	22·0	....	8·4	....	4·6
2	....	....	1·15	7·6	....	20·2	....	18·0	1·18	8·6	....	5·2
3	....	....	....	7·5	....	20·3	....	15·0	....	8·0	1·09	5·7
4	....	....	....	7·4	1·51	20·4	1·3	12·7	....	7·5	....	5·6
5	....	....	....	7·3	....	20·2	....	13·0	1·13	7·0	....	5·5
6	....	....	....	7·2	....	20·1	....	13·3	....	7·1	1·08	5·4
7	....	....	1·13	7·0	1·5	20·0	....	13·6	....	7·2	....	5·2
8	....	....	....	7·4	....	20·0	....	13·9	....	7·4	....	5·0
9	....	....	....	7·8	....	20·0	....	14·2	1·15	7·6	....	4·8
10	....	....	1·17	8·2	....	20·0	1·35	14·6	....	7·2	1·05	4·5
11	....	....	....	9·9	1·5	20·0	....	15·0	....	6·8	....	4·4
12	....	....	....	11·6	....	19·7	....	15·2	....	6·4	....	4·3
13	....	....	....	13·3	....	19·3	1·37	15·4	1·1	6·0	1·4	4·3
14	....	....	1,36	15·0	1·47	19·0	....	11·0	....	6·4	....	....
15	....	....	....	15·1	....	19·2	....	7·0	....	6·8	....	....
16	0·96	2·2	....	15·2	....	19·4	1·0	3·1	1·14	7·2	....	....
17	....	1·7	1·37	15·4	....	19·7	....	4·6	....	7·6	....	....
18	....	1·2	....	15·7	1·5	20·0	....	6·1	....	8·0	....	....
19	0·88	0·8	....	16·0	....	20·1	1·15	7·6	....	8·3	....	....
20	....	1·2	....	16·2	....	20·2	....	6·8	1·18	8·6	....	....
21	....	1·6	1·4	16·5	1·51	20·4	....	6·0	....	7·8	....	....
22	....	2·0	....	17·2	....	20·8	....	5·2	....	6·9	....	....
23	0·97	2·4	....	17·9	....	21·5	1·05	4·5	1·1	6·0	....	....
24	....	3·0	1·46	18·6	....	22·2	....	5·5	....	5·8	....	....
25	....	3·5	....	19·0	1·57	22·8	....	6·5	....	5·6	....	....
26	1·03	4·0	....	19·3	....	22·8	1·15	7·6	....	5·5	....	....
27	....	3·2	....	19·6	....	22·8	....	7·8	1·08	5·4	....	....
28	....	2·4	1·5	20·0	1·57	22·8	....	8·0	....	5·0	....	....
29	....	1·6	....	20·0	....	22·6	....	8·1	....	4·5	....	....
30	0·88	0·8	....	20·0	....	22·4	1·17	8·2	1·03	4·0	....	....
31	....	....	1·5	20·0	....	....	....	8·3	....	4·3	....	....

FRASER RIVER AT LYTTON.

Location.—Section 12, township 15, range 27, west 6th, meridian, at ferry about a mile above town of Lytton, and above the confluence of the Fraser and Thompson rivers,

Records Available.—February 20 to December 31, 1912; January 1 to December 31, 1913.

Winter Conditions.—Open flow throughout the year.

Gauge.—Gauge painted on rock and graduated to feet. Readings made by J. C. Lual.

Channel—The channel varies in width from 200 feet at low water to 800 feet at high water. The flow is uniform, but velocities are very great during the high stages of the water.

Discharge Measurements.—Seven well distributed meterings have been taken, ranging from 11,500 second-feet to 162,000 second-feet. The curve has been projected beyond these points.

Accuracy.—Conditions for gauge reading are good. Meterings are made from the ferry boat, which swings somewhat from side to side in the current, and probably affects the accuracy of the high-water measurements to a slight extent. The results, however, are considered to be within 10 per cent of the truth throughout.

Discharge Measurements of Fraser River at Lytton, 1913.

Date	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
September 5...	Cline and Chisholm..........	1055	540	7,860	9·53	21·0	74,90

Monthly Discharge of Fraser River at Lytton for 1913.

[Drainage area, 63,000 square miles.]

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage Area.	Total in acre-feet.
January	16,500	1,500	7,556	0·12	0·14	464,500
February	13,000	5,750	9,150	0·14	0·15	508,100
March	13,875	7,000	10,200	0·16	0·18	627,200
April	56,000	9,500	26,452	0·42	0·47	1,573,900
May	142,500	28,500	79,746	1·27	1·47	4,903,600
June	182,000	136,250	160,754	2·55	2·84	9,565,000
July	142,500	99,250	123,315	1·96	2·26	7,583,000
August	114,875	62,500	86,052	1·37	1·58	5,290,000
September	99,250	53,000	71,083	1·13	1·26	4,230,000
October	71,500	44,000	55,500	0·88	1·01	3,413,000
November	47,000	20,500	30,858	0·49	0·55	1,835,000
December	28,500	13,000	20,540	0·33	0·38	1,263,000
The year	182,000	1,500	56,767	0·90	12·29	41,256,300

Daily Gauge Heights and Discharges of Fraser River above mouth of Thompson River for 1912.

Day.	February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	....	....	7,800	9·5	10,800	18·0	51,200	30·0	126,500
2	....	....	9·0	8,800	....	12,400	19·00	56,800	29·0	119,800
3	....	....	....	8,800	....	14,000	....	62,600	28·0	113,200
4	....	....	....	8,800	....	15,600	21·0	68,500	27·0	106·600
5	....	....	9·0	8,800	....	17,200	....	65,500	26·0	100,000
6	....	....	....	8,800	11·5	18,900	20·0	62,500	24·0	87,000
7	....	....	....	8,800	....	19,400	20·0	62,500	24·0	87,000
8	....	....	....	8,800	....	19,900	....	68,500	24·0	87,000
9	....	....	....	8,800		20,400	22·0	74,500	23·0	80,700
10	....	....	9·0	8,800	....	21,000	22·0	74,500	23·0	80,700
11	....	....	....	8,800	....	23,200	23·0	80,700	24·0	87,000
12	....	....	....	8,800	13·0	25,500	....	80,700	25·0	93,500
13	....	....	9·0	8,800	13·5	27,900	23·0	80,700	26·0	100,000
14	....	....	....	9,100	....	28,700	23·0	80,700	27·0	106,600
15	....	....	....	9,400	....	29,500	24·0	87,000	28·0	113,200
16	....	....	....	9,700	14·0	30,300	25·5	96,750	29·0	119,800
17	....	....	....	10,000	....	31,500	27·0	106,600	30·0	126,500
18	....	....	....	10,400	14·5	32·800	29·0	119,800	31·0	133,500
19	....	....	9·5	10,800	....	35,400	....	126,600	29·0	119,800
20	10·5	14,800	....	10,800	15·5	37,850	31·0	133,500	30·0	126,500
21	....	13,800	....	10,800	....	39,100	29·0	119,800	32·0	140,500
22	....	12,800	9·5	10,800	16·0	40,400	28·0	113,200	35·0	162,000
23	....	11,800	10·0	12,800	....	41,300	28·0	113,200	36·0	169,500
24	9·5	10,800	....	10,800	....	42,200	28·0	113,200	36·0	169,500
25	....	10,100	9·0	8,800	16·5	43,000	28·0	119,800	36·5	173,000
26	....	9,400	9·5	10,800	....	45,700	....	126,600	34·0	155,500
27	9·0	8,800	....	10,800	17·5	48,400	31·0	133,500	34·0	155,500
28	....	7,800	9·5	10,800	....	49,300	33·0	148,000	33·0	148,000
29	8·5	6,800	....	10,800	....	50,200	34·0	155,500	32·0	140,500
30	....	7,506	....	10,800	18·0	51,200	34·0	159,250	....	137,000
31	....	....	....	10,800	....	....	32·5	144,250	....	....

DAILY GAUGE HEIGHTS AND DISCHARGES of Fraser River above mouth of Thompson River for 1912.

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	31·0	133,500	21·0	68,500	19·0	56,800	14·5	32,800	....	25,500	10·0	12,800
2	28·0	113,200	20·5	65,500	18·0	51,200	14·5	32,800	....	25,500	10,0	12,800
3	27·0	106,600	20·0	62,500	18·0	51,200	14·0	30,300	13·0	25,500	10·0	12,800
4	26·0	100,000	22·5	77,600	17·5	48,400	14·0	30,300	13·0	25,500	10·0	12,800
5	25·0	93,500	22·5	77,600	18·0	51,200	14·5	32,800	13·0	25,500	10·0	12,800
6	25·0	93,500	23·0	80,700	18·0	51,200	18·0	51,200	13·0	25,500	10·0	12,800
7	25·0	93,500	23·0	80,700	17·0	45,600	17·0	45,600	13·0	25,500	10·0	12,800
8	25·0	93,500	23·0	80,700	17·5	48,400	16·5	43,000	13·5	27,900	11·0	16,800
9	25·0	93,500	23·5	82,850	18·0	51,200	16·0	40,400	13·5	27,900	12·0	21,000
10	25·0	93,500	23·5	82,850	17·0	45,600	16·0	40,400	13·0	25,500	12·0	21,000
11	25·0	93,500	23·0	80,700	17·0	45,600	16·5	43,000	12·5	23,250	12·5	18,900
12	24·0	87,000	23·0	80,700	17·0	45,600	17·0	45,600	12·0	21,000	12·0	21,000
13	24·0	87,000	23·0	80,700	17·0	45,600	16·5	43,000	12·0	21,000	12·0	21,000
14	24·0	87,000	24·0	87,000	17·0	45,600	16·0	40,400	11·5	18,900	12·0	21,000
15	25·0	93,500	23·5	83,850	17·5	48,400	16·0	40,400	11·0	16,800	11·0	16,800
16	26·0	100,000	23·0	80,700	17·0	45,600	16·0	40,400	11·0	16,800	11·0	16,800
17	25·0	93,500	22·5	77,600	17·0	45,600	16·0	40,400	11·5	18,900	10·0	12,800
18	24·0	87,000	22·0	74,500	17·0	45,600	16·0	40,400	11·5	18,900	10·0	12,800
19	23·0	80,700	21·0	68,500	17·0	45,600	15·5	37,850	12·0	21,000	10·0	12,800
20	22·5	77,600	23·0	80,700	17·0	45,600	15·0	35,300	12·0	21,000	11·0	16,800
21	....	76,000	23·0	80,700	16·0	40,400	15·0	35,300	12·0	21,000	10·0	12,800
22	22·0	74,500	23·0	80,700	16·0	40,400	15·0	35,300	12·5	23,250	10·0	12,800
23	23·0	80,700	23·0	80,700	17·0	45,600	15·0	35,300	12·5	23,250	11·0	16,800
24	23·0	80,700	23·0	80,700	16·0	40,400	15·0	35,300	12·0	21,000	10·0	12,800
25	23·5	83,850	24·0	87,000	15·5	37,850	15·0	35,300	12·0	21,000	10·0	12,800
26	23·5	83,850	24·0	87,000	15·0	35,300	15·0	35,300	11·5	18,900	10·0	12,800
27	23·0	80,700	24·0	87,000	15·0	35,300	14·5	32,800	11·0	16,800	10·0	12,800
28	23·0	80,700	24·0	80,700	15·0	35,300	14·0	30,300	11·0	16,800	10·0	12,800
29	22·0	64,500	23·0	80,700	15·0	35,300	14·0	30,300	10·5	14,800	....	12,800
30	21·5	71,500	21·0	58,500	14·5	32,800	13·3	27,900	....	13,800	....	12,800
31	21·0	68,500	20·0	62,500	....	....	13·0	25,500	....	....	....	12,800

GREENSTONE CREEK.

Location.—Section 33, township 17, range 20, west 6th meridian.

Records Available.—May 1 to August 1, 1912; April 27 to August 24, 1913.

Winter Conditions.—Stream is generally dry during the months of October, November, December, January, February and March.

Gauge.—A vertical staff gauge, read semi-weekly by R. L. Burgess.

Channel.—The channel is about 10 feet in width. The maximum recorded flow was 95 second-feet, which occured on May 9, 1912.

Discharge Measurements.—The curve is only fairly well defined, although ten meterings have been made. A shifting channel is the probable cause of inaccuracy.

Accuracy.—The accuracy is not very high, but results are considered to be within 15 per cent of the truth.

GREENSTONE CREEK.

Greenstone creek has its source in Big Fish lake township 18, range 20, west 6th meridian, at an elevation of 4,820 feet, and discharges into Meadow creek 8 miles from the mouth, at an elevation of 4,000 feet. It is part of Guichon-Nicola-Thompson drainage; the drainage area, as measured from the Geological Survey map, dated 1895, scale 2 miles to 1 inch, is 20 square miles. This is a contentious irrigation stream, in the dry belt; the summers are hot and dry, the winters long and very cold (-30 F.); the mean annual precipitation is about 15 inches.

Greenstone creek is about 6 miles long, and drains Face and Big Fish lakes. There is no agricultural land except the Watson meadows at the mouth; there is a record of 1,000 inches appurtenant to this land. In addition the British Columbia Fruitlands Company, and the Beaton estate have records of 500 inches each to divert water from Face lake and Big Fish lake, respectively, into the Thompson drainage; while the mean run-off of the creek during the irrigation season of 1912 (an exceptionally wet season) was less than 10 second-feet, or 350 inches. The British Columbia Fruitlands Company propose to turn water from Face lake into the headwaters of Cherry creek, and thence via Cherry creek to their estates. The Beaton estate propose to build an earthen ditch 22 miles long in a northwesterly direction to their ranch in the Cherry creek valley; the ditch would receive water from Duffy, Chartrand, and Three-mile creeks, en route, provided the application for water for these estates were granted. The combined area of Big Fish and Face lakes is approximately 500 acres, and the lakes could be dammed to a height of 15 feet. Both of these schemes are meeting with strenuous opposition from the interests on Guichon creek.

The river station was established September 14, 1911, by W. M. Carlyle. The measuring section is located about half mile from the mouth. A standard vertical staff gauge is located on the left bank at the measuring section. All the measurements are made by wading, though in high water, measurements have to be made at the Chartrand-Trout lake road where the water runs in two channels. The measuring section is only fair, as part of the creek apparently sinks, reappearing below the measuring section. The control, however, is good, the current uniform, the channel permament, and the banks not liable to overflow unless the channel were blocked by logs, which are abundant.

Discharge Measurements of Greenstone Creek, near Mouth, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
May 10	H. J. E. Keys	1,057	10·5	7·1	2·7	0·98	19·3
May 28	do	1,057	10·	7·1	2·2	0·91	[1]15·5
Sept. 1	do	1,057	....	....	....	0·50	1·0

Note—Gauge Reader—R. L. Burgess.
[1]Estimated.

Montlhy Discharge of Greenstone Creek near Mouth for 1913.

(Drainage area, 20 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May	26	3·8	15·4	0·77	0·89	947
June	20·5	3·8	9·3	0·46	0·51	553
July	17·6	3·5	8·0	0·4	0·46	492
August	....	....	3·0	0·15	0·17	184

Note.—This station gives the flow from Big Fish lake to Face lake.

Daily Gauge Heights and Discharges of Greenstone Creek near Mouth for 1913.

Day.	April.		May.		June.		July.		August.	
	Gauge Height	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1				10·7		10·9		17·6		3·4
2				10·2		9·3		16·7		3·2
3				9·7		8·7	0·9	15·7		3·0
4			0·75	9·2		8·0		14·9		2·9
5				6·6	0·7	7·3		14·1		2·8
6			0·6	3·8		7·3	0·85	13·4		2·6
7				7·5		7·3		11·4	0·55	2·4
8			0·8	11·2	0·7	7·3		9·3		2·4
9				16·1		6·9	0·7	7·3	0·55	2·4
10				21·0		6·5		6·7		2·5
11			1·1	26·0		6·1		6·1		2·6
12				26·0		5·7	0·65	5·5		2·7
13			1·1	26·0		5·4		5·6		2·8
14				24·2		5·0		5·7		2·9
15				22·4		4·6		5·9		3·0
16			1·0	20·5		4·2		6·1		3·1
17				19·2	0·6	3·8		6·2		3·2
18				18·5		4·3		6·4		3·3
19				17·8		4·8		6·6		3·4
20				17·2	0·65	5·5		6·8		3·5
21				16·6		7·4		7·0		3·6
22				16·0	0·75	9·3		7·2		3·7
23				15·4		11·1	0·7	7·3	0·6	3·8
24				14·8		12·9		6·6		
25				14·2		14·7		6·0		
26				13·6		16·5		5·3		
27				13·0		18·4		4·5		
28	0·8	11·2		12·4	1·0	20·5	0·6	3·8		
29		11·2		11·8		19·5		3·7		
30	0·8	11·2	0·8	11·2		18·6		3·6		
31				10·6				3·5		

GUICHON CREEK (ABOVE MAMIT LAKE).

Location.—Water District No. 3, south of township 17, range 21, west 6th meridian.

Records Available.—June 3, 1911; January 1, 1912, to November 15, 1912; April 25, 1913, to September 29, 1913.

Winter Conditions.—Winter conditions exist during January, February and March, when the normal minimum flow is about 5 second-feet.

Gauge.—The gauge is a vertical staff gauge read daily by Miss Lillian Quenville.

Channel.—The channel is about 25 feet in width, and has a bed of sand and gravel. The maximum recorded flow is 4.35 second-feet, which occured on May 16, 1912.

Discharge Measurements.—The curve is well defined by numerous meterings.

Accuracy.—The accuracy of returns is high, and results are considered to be within 5 per cent of prevailing conditions.

Discharge Measurements of Guichon Creek, above Mamit Lake, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
May 28	H. J. E. Keys	1,057	26	77·6	1·6	3·44	126
Aug. 3	do	1,057	26	21·2	1·1	1·49	25·5
Aug. 17	do	1,057	24	16·3	1·06	1·20	17·3

Note.—Gauge reader, Miss Olive Quenville.

Monthly Discharge of Guichon Creek, above Mamit Lake, for 1913.

(Drainage area, 315 square miles).

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May	179	41	122	0·38	0·44	7,501
June	230	55	86	0·27	0·30	5,111
July	164	28	72	0·23	0·26	4,427
August	41	18	24	0·08	0·09	1,476
September	24	16	18	0·06	0·07	1,071

Note.—This station gives the amount of water available for storage purposes in Mamit lake. During the spring freshet, J. E. Leighton, of Savona, diverts water into Tunkwa lake, and thence into the Three-mile Creek watershed.

Daily Gauge Heights and Discharges of Guichon Creek near Mamit Lake for 1913.

Day.	April.		May.		June.		July.		August.		September.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	....	2·05	54	2·92	107	3·8	164	1·45	26	1·25	18
2	....	....	2·05	54	2·75	96	3·5	143	1·45	26	1·25	18
3	....	....	2·0	51	2·6	87	3·4	136	1·42	25	1·25	18
4	....	....	1·94	48	2·45	78	3·25	126	1·4	24	1·25	18
5	....	....	1·9	46	2·3	69	3·1	117	1·4	24	1·25	18
6	....	....	1·87	42	2·28	68	2·95	108	1·4	24	1·4	24
7	....	....	1·8	41	2·3	69	2·7	93	1·4	24	1·4	24
8	....	....	1·95	49	2·3	69	2·55	84	1·3	20	1·4	24
9	....	....	2·75	96	2·35	72	2·47	79	1·3	20	1·4	24
10	....	....	3·4	136	2·32	70	2·42	76	1·3	20	1·2	16
11	....	....	3·75	160	2·2	63	2·3	69	1·25	18	1·2	16
12	....	....	3·95	175	2·35	72	2·2	63	1·27	19	1·2	16
13	....	....	4·0	179	2·3	69	2·2	63	1·35	22	1·2	16
14	....	....	3·9	172	2·2	63	2·45	78	1·32	21	1·2	16
15	....	....	3·7	157	2·2	63	2·5	81	1·3	20	1·4	24
16	....	....	3·7	157	2·2	63	2·6	87	1·3	20	1·35	22
17	....	....	3·85	167	2·1	57	2·5	81	1·35	22	1·2	16
18	....	....	3·9	172	2·07	55	2·5	81	1·55	30	1·2	16
19	....	....	3·85	167	2·1	57	2·3	69	1·8	41	1·2	16
20	....	....	3·75	160	2·1	57	2·1	57	1·67	35	1·2	16
21	....	....	3·7	157	2·2	63	2·02	52	1·6	32	1·2	16
22	....	....	3·55	147	2·3	69	1·87	44	1·55	30	1·2	16
23	....	....	3·45	140	2·3	69	1·67	35	1·5	28	1·2	16
24	....	....	3·4	136	2·3	69	1·6	32	1·5	28	1·2	16
25	2·6	87	3·4	136	2·45	78	1·6	32	1·4	24	1·2	16
26	2·6	87	3·4	136	2·85	102	1·6	32	1·32	21	1·2	16
27	2·57	85	3·4	136	3·35	133	1·65	34	1·25	18	1·2	16
28	2·45	78	3·4	136	3·8	164	1·7	36	1·25	18	1·2	16
29	2·2	63	3·3	129	4·65	230	1·6	32	1·27	19	1·2	16
30	2·2	63	3·25	126	4·27	198	1·55	30	1·27	19	....	....
31	....	....	3·05	114	....	....	1·5	28	1·25	18	....	....

HAT CREEK AT HAT CREEK RANCH (NEAR ASHCROFT, B.C .).

Location.—Section 21, township 22, range 25, west 6th meridian, just above the crossing of the Cariboo road, Mile 12.

Records Available.—May 9 to August 16, 1911; April 25 to August 2, 1912; April 26 to September 30, 1913.

Winter Conditions.—Very short spells of severe cold; snowfall very light.

Gauge.—The gauge is a 4-foot staff nailed to a small tree near the Lillooet road, a short distance above the Hat Creek ranch. Readings were obtained daily by Thos. Brennan, during the irrigation season.

Channel.—The channel is straight for 30 or 40 feet above and below the gauge. Water is fairly swift, and there is a possibility that large freshets might cause a shifting of the stream bed.

Accuracy.—The stream was well rated during 1913, and the accuracy of returns for 1913 is high.

DISCHARGE MEASUREMENTS of Hat Creek, at Hat Creek Ranch, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
1913							
April 26	C. G. Cline	1,055	25	26·3	1·32	2·21	34·8
May 22	K. G. Chisholm	1,055	25	45·6	2·34	2·98	107·4
May 23	do	1,055	25	46·4	2·45	3·03	113·7
May 25	do	1,055	25	53·8	2·95	3·51	158·8
May 29	do	1,055	25	53·8	3·12	3·53	167·2
Aug. 1	do	1,055	24	21·4	0·88	1·99	18·8

MONTHLY DISCHARGE of Hat Creek at Hat Creek Ranch for 1913.

(Drainage Area 240 square miles).

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May	203	21	94·7	0·39	0·45	5,823
June	192	70	120·1	0·50	0·56	7,146
July	135	15	61·2	0·25	0·29	3,763
August	43	15	25·7	0·11	0·13	1,580
September	21	15	17·6	0·07	0·08	1,048

Daily Gauge Heights and Discharges of Hat Creek at Hat Creek for 1913.

Day.	April.		May.		June.		July.		August.		September.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	....	2·1	28	3·5	161	3·25	135	2·1	28	1·92	17
2	....	....	2·1	28	3·6	171	3·15	125	2·1	28	1·92	17
3	....	....	2·1	28	3·6	171	3·05	115	2·15	31	1·92	17
4	....	....	2·1	28	3·5	161	2·95	105	2·15	31	1·92	17
5	....	....	2·0	21	3·3	141	2·9	100	2·1	28	1·92	17
6	....	....	2·0	21	3·15	125	2·8	89	2·1	28	1·92	17
7	....	....	2·1	28	3·05	115	2·9	100	2·1	28	1·92	17
8	....	....	2·1	28	3·05	115	2·8	89	2·05	24	1·92	17
9	....	....	2·7	79	3·1	120	2·7	79	2·05	24	1·92	17
10	....	....	3·2	1·30	3·15	125	2·75	85	2·0	21	1·92	17
11	....	....	3·0	1·10	3·1	120	2·6	70	2·0	21	1·9	15
12	....	....	2·9	1·00	3·0	110	2·6	70	2·0	21	1·92	17
13	....	....	2·8	0·89	2·95	105	2·7	79	1·95	18	1·95	18
14	....	....	2·7	0·79	2·85	95	2·7	79	1·95	18	2·00	21
15	....	....	2·7	0·79	2·8	89	2·6	70	1·9	15	1·95	18
16	....	....	2·7	0·79	2·7	79	2·55	65	1·9	15	1·95	18
17	....	....	2·7	0·79	2·65	74	2·5	60	1·9	15	1·92	17
18	....	....	2·6	0·70	2·6	70	2·25	39	1·92	17	1·92	17
19	....	....	2·6	0·70	2·65	74	2·3	43	2·0	21	1·92	17
20	....	....	2·8	0·89	3·0	110	2·25	39	2·1	28	1·92	17
21	....	....	2·9	1·00	2·85	95	2·2	35	2·15	31	1·92	17
22	....	....	3·0	1·10	2·8	89	2·15	31	2·2	35	1·92	17
23	....	....	3·1	1·20	2·7	79	2·1	28	2·25	39	2·0	21
24	....	....	3·3	1·41	2·8	89	2·05	24	2·3	43	2·0	21
25	....	....	3·5	1·61	2·95	1·05	2·0	21	2·25	39	1·95	18
26	2·2	35	3·7	1·82	3·25	1·35	1·95	18	2·25	39	1·95	18
27	2·2	35	3·9	2·03	3·8	1·92	1·9	15	2·22	37	1·95	18
28	2·2	35	3·8	1·92	3·7	1·82	1·95	18	2·02	23	1·95	18
29	2·1	28	3·6	1·71	3·5	1·61	2·05	24	1·92	17	1·95	18
30	2·1	28	3·4	1·51	3·35	1·46	2·05	24	1·92	17	1·95	18
31	2·1	28	3·3	1·41	....	....	2·05	24	1·92	17	1·95	18

HAT CREEK (UPPER STATION).

Location.—Section 18, township 19, range 26, west 6th meridian at Colley's ranch, just above the Hammond diversion.

Records Available.—April 22, 1911, to December 31, 1911; January 1, 1912, to November 18, 1912; April 30, 1913, to December, 1913.

Winter Conditions.—Stream frequently open during winter months. Snowfall is about 4 feet per annum, while the mean annual rainfall is probably about 10 to 12 inches, making the total annual precipitation 14 inches to 16 inches.

Gauge.—A Standard vertical staff gauge is used, which is read daily by Thos. King.

Channel.—The channel is 12 to 14 feet in width, and is straight above and below the gauge. The control is good.

Discharge Measurements.—Well-distributed measurements have been obtained covering the stream's range. Meterings are made in the box flume above the Hammond diversion weir.

Accuracy.—Conditions for metering are good, and gauge readings were carefully taken. Accuracy is fairly high (within 10 per cent).

HAT CREEK.

Hat creek is an important and contentious irrigation stream in the Dry Belt of British Columbia. It rises in the hills about 15 miles west of Ashcroft, in the Hat Creek forest reserve, at an elevation of about 4,300 feet; and after flowing northerly for nearly 40 miles discharges into Bonaparte River from the west, about 14 miles from Ashcroft, at an elevation of about 2,000 feet.

It is part of the Bonaparte-Thompson drainage. The drainage area of Hat creek above the mouth is about 240 square miles, and above the Hammond diversion is about 47 square miles.

The creek varies in width from 15 to 20 feet, and is from 1 to 3 feet deep.

The precipitation at the mouth is only about from 9 inches to 10 inches, while at Upper Hat creek it probably is from 10 inches to 12 inches.

The summers are quite hot and generally dry, the evenings being cool. The winters are long and severe. The snowfall in Upper Hat creek is about 4 feet, but is less near the mouth.

Hat Creek valley is mostly timbered with bull pine, poplar, and some willow, with a few open patches of land.

The hills are mostly open range lands, or timbered with bull pine, jack pine, spruce, and fir.

The valley varies in width from 1 mile to several hundred yards. The hills in the upper part of the watershed rise to a height of 5,000 feet above the sea.

The upper bench lands, owing to their elevation above Hat creek, cannot be irrigated from the main stream, and several of the small tributaries are used, but the supply of water is not sufficient to give promise of much future development.

In the valley there are a number of good farms and ranches, all requiring irrigation. The soil is mostly a sandy loam with sandy and gravelly subsoil. Near the lower part of the valley, fruit is successfully grown, but in the upper valley of Hat creek, ranching and mixed farming must be resorted to.

Hat Creek ranch, at the mouth of Hat Creek, uses water for irrigation. Water is also used by Robertson Duck (Chinaman), Parke, Darragh, Smith, Pocock, and King, while the Indians in the lower valley use a little. In Upper Hat creek the growing season is short, and not as much water is necessary as near the mouth.

Exclusive of several water records on small tributaries, there is a total of 8,450 miners inches (237 c.f.s.) recorded on Hat creek. Many of these records, appurtenant to land, in Bonaparte valley, have never been used, nor probably will be, owing to impracticability and the heavy expense involved in the construction of the necessary irrigation works. It is probable that many of these old records will be cancelled by the British Columbia Board of Investigation.

There are also several water records allowing the diversion of water from Upper Hat creek into the Oregon Jack creek divide, for use on lands near Ashcroft.

Mr. W. H. Hammond, who owns the Basque ranch, holds the Minnaberriet and Langley records for about 600 miner's inches, dated 1871 and 1883, and diverts water from Upper Hat creek at Colley's homestead. His canal is about 2 miles long, and delivers the water into Oregon Jack creek divide reservoir site, whence it gradually seeps into Oregon Jack creek and down that stream to Hammond's ditch to Basque ranch. There is considerable water lost through seepage, percolation and evaporation in the swampy reservoir.

The Ashcroft Water, Electric and Improvement Company also holds a record from Upper Hat creek for 1,000 miner's inches, dated 1906, allowing the diversion of the surplus waters of Hat creek, said waters to be stored in the same Oregon Jack Creek divide reservoir, then taken down Oregon Jack creek to be used on certain lands west and north of Ashcroft.

This record has never been operated, and there is a dispute between this company and the owner of the Basque ranch regarding the rights to use the Oregon Jack creek divide reservoir.

The company proposes to construct large storage works, dams, etc., sufficient to store from 8,000 to 10,000 acre-feet.

The dispute between the two rival holders will have to be settled by the British Columbia Board of Investigation. In the meantime the reservoir, which is Dominion land, has not been granted to either applicant.

Hat creek has many small tributaries, viz: (from the left going upstream) Boundary, Parks, Cattle, Medicine, and Blue-earth creeks; (from the right going upstream) Graves, Anderson, Pocock, King, and Colley creeks. Miscellaneous measurements of discharge have been taken on several of these tributaries.

At the head of Blue-earth creek, which enters above Hammond's diversion, is a small storage lake, Blue-earth lake. For details of Blue-earth reservoir see "Blue-earth creek".

There have been several hydrographic stations established on Hat creek, viz: Hat creek (at Colley's ranch), Hammond's ditch, and Hat creek (at Hat Creek ranch) near mouth.

Measurements were also made at Hat Creek ranch, showing the quantity of water used there for irrigation.

Measurements were taken to find the loss in the Hammond ditch between the intake and the reservoir in Oregon Jack divide.

Discharge Measurements of Hat Creek, above Hammond's Ditch 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
April 28	Cline & Chisholm	1,055	11·5	5·4	1·18	0·25	6·2
Aug. 3	K. G. Chisholm	1,055	9·0	5·2	1·00	0·24	5·4

Monthly Discharge of Hat Creek, above Hammond's Ditch for 1913.

(Drainage area, 47 square miles).

Month.	Discharge in Second-Feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May	49·0	5·0	25·4	0·54	0·62	1,562
June	42·0	15·0	23·1	0·49	0·55	1,368
July	24·5	6·7	14·1	0·30	0·35	867
August	10·5	6·0	7·2	0·15	0·17	443
September	5·0	4·2	4·7	0·10	0·11	280
October	10·5	3·7	4·4	0·09	0·10	270
November	3·7	2·5	3·4	0·07	0·08	202
December	3·7	2·5	2·9	0·06	0·07	183

Daily Gauge Heights and Discharges of Hat Creek above Hammond's Ditch for 1913.

Day.	April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	....	0·25	6·7	0·95	41·8
2	....	....	0·19	4·8	0·85	35·5
3	....	....	0·23	6·0	0·95	41·8
4	....	....	0·21	5·3	0·85	35·5
5	....	....	0·25	6·7	0·75	29·7
6	....	....	0·23	6·0	0·65	24·5
7	....	....	0·40	12·5	0·65	24·5
8	....	....	0·25	6·7	0·60	22·0
9	....	....	0·85	35·5	0·55	19·5
10	....	....	0·85	35·5	0·60	22·0
11	....	....	0·75	29·7	0·55	19·5
12	....	....	0·65	24·5	0·45	14·7
13	....	....	0·65	24·5	0·45	14·7
14	....	....	6·00	22·0	0·45	14·7
15	....	....	0·65	24·5	0·45	14·7
16	....	....	0·55	19·5	0·45	14·7
17	....	....	0·60	22·0	0·45	14·7
18	....	....	0·55	19·5	0·45	14·7
19	....	....	0·65	24·5	0·55	19·5
20	....	....	0·75	29·7	0·55	19·7
21	....	....	0·60	22·0	0·45	14·5
22	....	....	0·85	35·5	0·50	17·0
23	....	....	0·75	29·7	0·45	14·7
24	....	....	0·95	41·8	0·55	19·5
25	....	....	0·85	35·5	0·55	19·5
26	....	....	1·05	48·7	0·45	24·5
27	....	....	0·95	41·8	0·85	35·5
28	....	....	10·5	48·7	0·75	29·7
29	0·25	6·7	0·95	41·8	0·75	29·7
30	0·15	3·7	0·95	41·8	0·75	29·7
31	....	....	....	35·5	....	....

DAILY GAUGE HEIGHTS AND DISCHARGES of Hat Creek above Hammonds Ditch for 1913.—*Continued.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	0·65	24·5	0·29	8·1	0·20	5	0·16	4·0	0·15	3·7	0·15	3·7
2	0·60	22·0	0·25	6·7	0·20	5·0	0·16	4·0	0·15	3·7	0·15	3·7
3	0·55	19·5	0·25	6·7	0·20	5·0	0·16	4·0	0·15	3·7	0·15	3·7
4	0·55	19·5	0·25	6·7	0·20	5·0	0·16	4·0	0·15	3·7	0·15	3·7
5	0·55	19·5	0·25	6·7	0·20	5·0	0·16	4·0	0·15	3·7	0·15	3·7
6	0·55	19·5	0·25	6·7	0·20	5·0	0·16	4·0	0·15	3·7	0·15	3·7
7	0·55	19·5	0·25	6·7	0·20	5·0	0·16	4·0	0·15	3·7	0·15	3·7
8	0·53	18·5	0·25	6·7	0·20	5·0	0·16	4·0	0·15	3·7	0·15	3·7
9	0·50	17·0	0·25	6·7	0·20	5·0	0·16	4·0	0·15	3·7	0·15	3·7
10	0·55	19·5	0·25	6·7	0·20	5·0	0·16	4·0	0·15	3·7	0·15	3·7
11	0·50	17·0	0·25	6·7	0·20	5·0	0·16	4·0	0·15	3·7	0·15	3·7
12	0·45	14·7	0·25	6·7	0·20	5·0	0·16	4·0	0·15	3·7	0·15	3·7
13	0·45	14·7	0·25	6·7	0·20	5·0	0·25	6·7	0·15	3·7	0·10	2·5
14	0·45	14·7	0·25	6·7	0·20	5·0	0·35	10·5	0·15	3·7	0·10	2·5
15	0·43	13·8	0·28	7·8	0·20	5·0	0·15	3·7	0·15	3·7	0·10	2·5
16	0·45	14·7	0·29	8·1	0·17	4·2	0·15	3·7	0·15	3·7	0·10	2·5
17	0·40	12·5	0·33	9·7	0·17	4·2	0·15	3·7	0·15	3·7	0·10	2·5
18	0·43	13·8	0·35	1·05	0·17	4·2	0·25	6·7	0·15	3·7	0·10	2·5
19	0·39	12·1	0·35	1·05	0·17	4·2	0·25	6·7	0·15	3·7	0·10	2·5
20	0·40	12·5	0·30	8·5	0·17	4·2	0·25	6·7	0·15	3·7	0·10	2·5
21	0·35	10·5	0·30	8·5	0·17	4·2	0·15	3·7	0·15	3·7	0·10	2·5
22	0·35	10·5	0·25	6·7	0·18	4·5	0·15	3·7	0·15	3·7	0·10	2·5
23	0·33	9·7	0·25	6·7	0·18	4·5	0·15	3·7	0·10	2·5	0·10	2·5
24	0·33	9·7	0·25	6·7	0·18	4·5	0·15	3·7	0·10	2·5	0·10	2·5
25	0·35	10·5	0·25	6·7	0·18	4·2	0·15	3·7	0·10	2·5	0·10	2·5
26	0·33	9·7	0·25	6·7	0·18	4·5	0·15	3·7	0·10	2·5	0·10	2·5
27	0·30	8·5	0·25	6·7	0·18	4·5	0·15	3·7	0·10	2·5	0·10	2·5
28	0·27	7·4	0·23	6·0	0·18	4·5	0·15	3·7	0·10	2·5	0·10	2·5
29	0·25	6·7	0·23	6·0	0·17	4·2	0·15	3·7	0·10	2·5	0·10	2·5
30	0·25	6·7	0·23	6·0	0·17	4·2	0·15	3·7	0·10	2·5	0·10	2·5
31	0·25	6·7	0·23	6·0	....	....	0·15	3·7	....	....	0·10	2·5

HAT CREEK (HAMMOND'S DIVERSION.)

Location.—Section 17, township 19, range 26, west 6th meridian.

Records Available.—Computed indirectly during 1911 (irrigation season); May 8 to August 25, 1912; May 28 to September 28, 1913.

Winter Conditions.—Snowfall about 4 feet in winter months. Water in ditch only during irrigation season.

Gauge.—Vertical staff gauge, read daily during irrigation period by Thos. King.

Channel.—Ditch is about 6 feet wide and 2 feet deep, with a carrying capacity of about 20 second-feet The loss by seepage in the gravelly portions is considerable, as well as in the timber fluming.

Discharge Measurements.—The rating curve is well defined, frequent meterings having been made.

Accuracy.—Accuracy of returns appended is high, and are considered to be within 10 per cent of conditions actually obtaining.

HAT CREEK (IN HAMMOND'S DITCH.)

Hammond's ditch diverts water from Upper Hat creek at Colley's ranch, about 22nd mile from the mouth of the stream. It discharges the water into a large swampy reservoir in the divide between Hat creek and Oregon Jack creek, whence the water runs into Oregon Jack creek, and is used for irrigation

on the Basque ranch, southwest of Ashcroft in the Thompson drainage area. A large quantity of the water diverted by Hammond's ditch is lost by seepage and evaporation in the so-called reservoir before it reaches Oregon Jack creek.

The ditch is nearly 2 miles long. It is mostly side-hill ditch, with several lengths of timber fluming. It runs along the lower contour of the hills to the south of the divide. The ditch is about 6 feet wide and 2 feet deep. It has a maximum capacity of about 20 c.f.s. The greatest quantity that has yet been diverted at any time is 14 c.f.s., the mean velocity being only 1.5 feet per second.

A regular gauging station was established in Hammond's ditch on May 9, 1912, and the readings were taken after the headgate was closed on August 26; also during season of 1913.

The gauge is a vertical staff fastened to the side of the overflow spillway, about 10 feet below the overflow sluiceway, and 100 yards below the intake. The zero of the gauge is referred to one bench-mark.

The meter measurements were made in the spillway box, by means of a current-meter attached to a wading rod.

In 1911, the amount of water diverted was computed from the difference between the daily discharges recorded by the upper and lower gauges at the gauging station at Colley's ranch.

Monthly Discharge of Hammond's Ditch at Head Gates for 1913.

Month.	Discharge in Second-Feet.			Run-Off.
	Maximum.	Minimum.	Mean.	Total in acre-feet.
May	12·1	0·0	1·6	96
June	14·3	9·9	11·1	660
July	11·0	5·8	8·6	531
August	5·8	2·8	5·3	324
September	4·6	0·0	3·3	196
Total quantity diverted				1,807

Discharge Measurements of Hammond's Ditch at Head Gates for 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Aug. 3	K. G. Chisholm	1055	5·5	4·2	1·21	0·78	5·08
" 3	do	1055	5·5	3·52	0·93	0·56	3·26
" 3	do	1055	5·5	2·93	0·80	0·47	2·33
" 3	do	1055				0·18	0·0

Daily Gauge Heights and Discharges of Hat Creek in Hammonds Ditch at Head Gates for 1913.

Day.	May.		June.		July.		August.		September.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	....	1·08	12·1	0·98	9·9	0·78	5·8	0·58	2·8
2	....	....	1·08	12·1	0·98	9·9	0·78	5·8	0·63	3·3
3	....	....	1·18	14·3	1·03	11·0	0·78	5·8	0·68	4·1
4	....	....	1·18	14·3	0·93	8·6	0·78	5·8	0·63	3·3
5	....	....	1·08	12·1	0·98	9·9	0·78	5·8	0·68	4·1
6	....	....	1·08	12·1	0·98	9·9	0·78	5·8	0·68	4·1
7	....	....	1·08	12·1	0·98	9·9	0·78	5·8	0·71	4·6
8	....	....	1·08	12·1	0·98	9·9	0·78	5·8	0·68	4·1
9	....	....	1·08	12·1	1·03	11·0	0·78	5·8	0·68	4·1
10	....	....	1·08	12·1	0·98	9·9	0·76	5·7	0·68	4·1
11	....	....	0·98	9·9	0·98	9·9	0·73	4·9	0·68	4·1
12	....	....	1·03	11·0	0·98	9·9	0·73	4·9	0·68	4·1
13	....	....	1·08	12·1	0·98	9·9	0·73	4·9	0·68	4·1
14	....	....	0·98	9·9	0·96	9·5	0·73	4·9	0·68	4·1
15	....	....	1·03	11·0	0·94	9·0	0·73	4·9	0·66	3·8
16	....	....	0·98	9·9	0·98	9·9	0·78	5·8	0·66	3·8
17	....	....	1·03	11·0	0·96	9·5	0·78	5·8	0·63	3·3
18	....	....	0·98	9·9	0·93	8·6	0·78	5·8	0·63	3·3
19	....	....	0·98	9·9	0·94	9·0	0·78	5·8	0·63	3·3
20	....	....	0·98	9·9	0·93	8·6	0·78	5·8	0·63	3·3
21	....	....	1·03	11·0	0·88	7·8	0·78	5·8	0·63	3·3
22	....	....	1·03	11·0	0·88	7·8	0·78	5·8	0·63	3·3
23	....	....	0·98	9·9	0·88	7·8	0·78	5·8	0·63	3·3
24	....	....	1·03	11·0	0·83	6·8	0·78	5·8	0·63	3·3
25	....	....	0·98	9·9	0·88	7·8	0·78	5·8	0·63	3·3
26	....	....	0·98	9·9	0·83	6·8	0·73	4·9	0·63	3·3
27	....	....	0·98	9·9	0·78	5·0	0·68	4·1	0·63	3·3
28	1·08	12·1	1·03	11·0	0·78	5·8	0·68	4·1	....	....
29	1·08	12·1	1·03	11·0	0·78	5·8	0·64	3·5	....	....
30	1·08	12·1	0·98	9·9	0·82	6·4	0·63	3·3	....	....
31	1·08	12·1	....	....	0·78	5·8	0·58	2·8	....	....

HEFFERLY CREEK (LOWER STATION)

Location.—Section 11, township 22, range 17, west 6th meridian.

Records Available.—August 19, 1911, to October 31, 1911; April 3, 1912, to September 15, 1912; April 13, 1913, to September 15, 1913.

Winter Conditions.—Stream is usually frozen over during winter months.

Gauge.—Vertical staff gauge, read daily by J. W. Austin.

Channel.—The channel is about 15 feet in width and the bed rocky. The flow varies from a minimum of zero to a maximum of 100 cubic feet per second. The flow is partly subject to artificial regulation by a dam on Hefferly lake.

Discharge Measurements.—The stream is well rated except for a very short period at the peak of the freshet.

Accuracy.—The accuracy of returns is high (within 5 per cent).

HEFFERLY CREEK.

Hefferly creek has its source in Hefferly lake, near the divide into Louis creek, at an elevation of 3,100 feet and, flowing westerly, empties into North Thompson river, near Hefferly creek post office (about 14 miles from Kamloops), at an elevation of 1,150 feet. The stream is about 10 miles long, from 15 to 25 feet wide, and from 6 inches to 2 feet deep. Hefferly lake is about 2 miles long and several hundred yards wide, and is used as a storage reservoir for irrigation purposes. The water users have co-operated and constructed a small dam at the outlet of the lake, and the spring freshet is mostly

conserved. It is not possible to greatly increase the capacity of the reservoir without damming the easterly end of the lake as well, on account of the low divide into Louis creek.

Hefferly creek, like so many of the streams in the dry belt, is vastly over-recorded for irrigation purposes, but by storage and careful use there is enough water for all the lands in the valley and at the mouth. The earliest records are apurtenant to the Austen and Anderson places, near the mouth of the creek, and the waters of the creek are used mostly on these lowlands. The Anderson interests have recently been formed into the North Thompson Ranching Company, and it is proposed to construct a high line canal, beginning near the lake, and irrigate several thousand acres of sloping bench lands on the south side of the Hefferly valley. Austen owns a large tract of land at the mouth of the creek, and has purchased some of Anderson's bottom lands. There are several small farms in the valley, but they depend on the water that is not required by Anderson and Austen.

The hills of the Hefferly drainage rise to a height of 4,000 feet, and are fairly well covered with timber, bull pine, jack pine, and some fir. The upper slopes are excellent range lands.

The precipitation of Hefferly drainage is probably about 20 inches, near the headwaters, which rise near Louis creek and the easterly limit of the dry belt. At the mouth of the creek the precipitation is not more than 10 inches per annum. with only a small rainfall during the growing season.

Hefferly Creek, below Hefferly Lake.

This gauging station is a combination of three stations, viz: Hefferly creek, upper station, Anderson's diversion, and Crawshaws ditch (No. 239). These three stations were established on June 25, 1911, by C. G. Cline, and gauge readings were taken during the irrigation season of 1911 and 1912. The object of the three stations was to measure the amount of water used by each ditch, and by combining all three to obtain the total flow of the creek coming from Hefferly lake. Moreover, it was difficult to obtain a gauge reader for a station above Anderson intake.

A vertical staff gauge was placed at each station, and the datum of each was referred to three bench-marks.

The data of discharge here given were obtained, as has been stated, by combining the flow of all three stations. The quantity of water running in the Anderson and Crawshaw ditches is also published.

Hefferly Creek, at mouth.

This station was established on August 19, 1911, by C. G. Cline. It is located above Austen's diversion, near the mouth of the creek, about 100 yards upstream from the Hefferly Creek bridge, and 40 feet from the road. The gauge is a vertical staff, 5 feet long, and is nailed to a fallen fir tree on the left bank of the creek. The datum of the gauge is referred to three bench-marks. The banks are from 3 to 5 feet high, and do not overflow at high water. Measurements are made with a current-meter by the wading method, at a section about 100 feet below the gauge, This station shows the total flow of Hefferly creek, except that which is used by Anderson and Crawshaw, and includes the flow of Edwards creek. Hefferly creek below the Austen headgates is dry during the irrigation season, as nearly all the water is used.

Discharge Measurements of Hefferly Creek at Lower Station, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
June 25......	H. J. E. Keys................	1,057	13	10·1	1·04	1·32	10·5

Monthly Discharge of Hefferly Creek at Lower Station for 1913.

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
April....................................	20·7	7·5	10	0·15	0·17	590
May....................................	28·5	8·9	17·3	0·26	0·30	1,060
June....................................	16·1	7·5	10·5	0·16	0·18	625
July....................................	12·9	3·3	7·3	0·11	0·13	450
August....................................	11·0	2·0	6·9	0·11	0·13	420

Note.—Accuracy "A".

Daily Gauge Heights and Discharges of Hefferly Creek at Lower Station for 1913.

Day.	April.		May.		June.		July.		August.		September.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1............	....	....	1·35	12·1	1·4	14·0	1·35	12·1	1·0	3·3	1·25	....
2............	....	....	1·3	10·3	1·4	14·0	1·35	12·1	1·0	3·3	1·27	....
3............	....	....	1·25	8·9	1·4	14·0	1·3	10·3	0·97	2·9	1·3	....
4............	....	....	1·25	8·9	1·3	10·3	1·3	10·3	0·95	2·6	1·32	....
5............	....	....	1·25	8·9	1·3	10·3	1·3	10·3	0·90	2·0	1·30	....
6............	....	....	1·25	8·9	1·3	10·3	1·3	10·3	0·92	2·6	1·27	....
7............	....	....	1·25	8·9	1·3	10·3	1·2	7·5	1·2	7·5	1·22	....
8............	....	....	1·25	8·9	1·3	10·3	1·15	6·3	1·32	11·0	1·25	....
9............	....	....	1·4	14·0	1·3	10·3	1·15	6·3	1·3	10·3	1·25	....
10............	....	....	1·7	28·5	1·2	7·5	1·15	6·3	1·25	8·9	1·25	....
11............	....	....	1·65	25·8	1·2	7·5	1·15	6·3	1·22	8·1	1·25	....
12............	....	....	1·7	28·5	1·2	7·5	1·17	6·8	1·27	9·5	1·25	....
13............	1·3	10·3	1·6	23·2	1·2	7·5	1·22	8·1	1·27	9·5	1·25	....
14............	1·2	7·5	1·6	23·2	1·2	7·5	1·32	11·0	1·25	8·9	1·22	....
15............	1·2	7·5	1·6	23·2	1·2	7·5	1·37	12·9	1·27	9·5	1·2	....
16............	1·3	10·3	1·55	20·7	1·2	7·5	1·32	11·0	1·25	8·9	....	....
17............	1·3	10·3	1·55	20·7	1·2	7·5	1·27	9·5	1·2	7·5	....	....
18............	1·4	14·0	1·55	20·7	1·2	7·5	1·22	8·1	1·2	7·5	....	....
19............	1·5	18·2	1·55	20·7	1·2	7·5	1·2	7·5	1·2	7·5	....	....
20............	1·5	18·2	1·5	18·2	1·2	7·5	1·15	6·3	1·2	7·5	....	....
21............	1·55	20·7	1·5	18·2	1·2	7·5	1·15	6·3	1·2	7·5	....	....
22............	1·5	18·2	1·5	18·2	1·35	12·1	1·12	5·6	1·2	7·5	....	....
23............	1·4	14·0	1·5	18·2	1·4	14·0	1·07	4·6	1·17	6·8	....	....
24............	1·4	14·0	1·5	18·2	1·4	14·0	1·05	4·2	1·17	6·8	....	....
25............	1·4	14·0	1·5	18·2	1·35	12·1	1·02	3·7	1·15	6·3	....	....
26............	1·4	14·0	1·5	18·2	1·35	12·1	1·05	4·2	1·15	6·3	....	....
27............	1·35	12·1	1·5	18·2	1·45	16·1	1·02	3·7	1·15	6·3	....	....
28............	1·35	12·1	1·5	18·2	1·4	14·0	1·05	4·2	1·15	6·3	....	....
29............	1·35	12·1	1·45	16·1	1·4	14·0	1·05	4·2	1·15	6·3	....	....
30............	1·35	12·1	1·45	16·1	1·35	12·1	1·05	4·2	1·15	6·3	....	....
31............	....	....	1·45	16·1	....	....	1·05	3·3	1·25	8·9	....	....

HEFFERLY CREEK BELOW HEFFERLY LAKE.

Location.—Section 3, township 22, range 16, west 6th meridian.

Records Available.—June 25 to November 30, 1911; April 1 to September 20, 1912; May 11 to September 19, 1913.

Winter Conditions.—Climatic conditions are somewhat similar to those at Kamloops, except for the fact that owing to the greater altitude of the drainage basin of Hefferly Creek, the winter is slightly longer and the precipitation (rainfall and snowfall) more excessive.

Gauges.—The flow out of Hefferly lake is arrived at by the summation of flow of Anderson's ditch, Crawshaw's ditch and Hefferly creek below these two diversions which take water from the creek (during the irrigation season) below the lake and above the hydrographic survey gauge. During the coming season the flow out of Hefferly lake will be directly measured. Mr. F. S. Lawrence acts as gauge reader. The three gauges are standard vertical staff gauges.

Channel.—Channel is about 10 to 15 feet in width, gradient is steep, and control good. During extreme high water trouble has been met with owing to backwater from the highway bridge. This was however of very short duration and results were not appreciably effected.

The channel of the Anderson ditch is very gravelly, and there is much loss by seepage.

Discharge Measurements.—Eight well distributed measurements were made on the stream during 1911-12-13.

Accuracy.—Gauge readings were accurate, and conditions excellent at the regular station, but poor conditions existed for current-meter work on the Anderson and Crawshaw ditches. Accuracy on the whole is only fair during the irrigation season, but high during that period when no diversion was being made.

Discharge Measurements of Anderson diversion of Hefferly Creek near Lawrence Ranch, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
June 26	H. J. Keyes	1,057	7	4·06	1·3	1·18	5·25

Monthly Discharge of Crawshaw Ditch for 1913.

Month.	Discharge in Second-Feet.			Run-Off.
	Maximum.	Minimum.	Mean.	Total in acre-feet.
May	2·6	0·0	1·3	80
June	3·5	1·4	2·9	173
July	3·5	0·0	0·9	55
August	3·5	0·0	0·7	43

Note.—Total water diverted in 1913 = 351 acre-feet.

MONTHLY DISCHARGE of Anderson's ditch near Lawrence's Ranch, Upper Station for 1913.

Month.	Discharge in Second-Feet.			Run-Off.
	Maximum.	Minimum.	Mean.	Total in acre-feet.
May	6·5	0·0	3·5	215
June	8·4	1·1	6·5	387
July	4·3	1·0	2·6	160
August	5·7	3·3	4·3	264
September	5·0	0·0	2·1	125

NOTE.—Total amount of water diverted in 1913 = 1,151 acre-feet.

MONTHLY DISCHARGE of Hefferly Creek below Hefferly Lake for 1913.

Month.	Discharge in Second-Feet.			Run-Off.
	Maximum.	Minimum.	Mean.	Total in acre-feet.
May	9·2	4·4	6·3	387
June	9·2	5·1	7·05	419
July	5·7	1·0	2·07	127
August	23·2	1·4	10·7	658
September	17·9	0·5	10·5	625

NOTE.—The drainage area is not used in this table because there is a diversion above the station.

MONTHLY DISCHARGE of Hefferly Creek. Total flow below Hefferly Lake for 1913.

(Drainage Area 30 Square Miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May	....	....	11·1	0·37	·43	682
June	....	....	16·5	0·55	·61	982
July	....	....	5·6	0·19	·22	344
August	....	....	15·7	0·52	·60	965

NOTE.—These figures are the sum of the flow in the creek below two diversions and the two diversions themselves and give the actual flow from Hefferly lake.

DAILY GAUGE HEIGHTS AND DISCHARGES of Hefferly Creek at Anderson's Ditch for 1913.

Day.	May.		June.		July.		August.		September.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	....	1·25	6·5	0·75	1·0	....	3·3	1·1	4·3
2	....	....	1·25	6·5	0·75	1·0	1·0	3·0	1·1	4·3
3	....	....	1·25	6·5	0·75	1·0	....	3·3	1·1	4·3
4	....	....	1·25	6·5	0·75	1·0	1·05	3·6	1·15	5·0
5	....	....	1·3	7·4	0·8	1·2	1·05	3·6	1·15	5·0
6	....	....	....	7·4	0·8	1·2	1·05	3·6	1·1	4·3
7	....	....	1·3	7·4	....	1·6	1·2	5·7	1·05	3·6
8	....	....	1·3	7·4	0·9	2·0	....	5·4	1·05	3·6
9	....	....	1·3	7·4	....	2·5	1·15	5·0	1·05	3·6
10	....	....	1·3	7·4	1·0	3·0	1·15	5·0	1·05	3·6
11	1·1	4·3	1·3	7·4	0·95	2·5	1·1	4·3	1·05	3·6
12	....	4·3	1·3	7·4	0·95	2·5	1·15	5·0	1·05	3·6
13	1·1	4·3	1·3	7·4	0·95	2·5	1·1	4·3	1·05	3·6
14	....	4·3	1·3	7·4	1·0	3·0	....	4·7	1·05	3·6
15	1·1	4·3	....	7·9	1·05	3·6	1·15	5·0	1·05	3·6
16	1·1	4·3	1·35	8·4	1·0	3·0	1·1	4·3	1·0	3·0
17	1·05	3·6	1·35	8·4	1·0	3·0	....	4·3	0·7	0·9
18	1·05	3·6	1·3	7·4	1·0	3·0	1·1	4·3	0·6	0·8
19	1·1	4·3	1·35	8·4	1·0	3·0	1·1	4·3	0·6	0·8
20	1·1	4·3	1·3	7·4	....	3·0	1·1	4·3	....	....
21	....	5·0	1·35	8·4	1·0	3·0	1·1	4·3	....	....
22	1·2	5·7	1·35	8·4	1·0	3·0	1·1	4·3	....	....
23	1·2	5·7	1·35	8·4	1·0	3·0	1·1	4·3	....	....
24	1·2	5·7	....	7·9	....	2·8	....	4·3	....	....
25	1·25	6·5	1·3	7·4	0·95	2·5	1·1	4·3	....	....
26	1·25	6·5	0·9	2·0	....	2·6	1·1	4·3	....	....
27	....	6·1	0·8	1·2	....	2·8	1·1	4·3	....	....
28	1·2	5·7	0·8	1·2	1·0	3·0	....	4·3	....	....
29	1·25	6·5	....	1·1	....	3·6	....	4·3	....	....
30	1·25	6·5	....	1·1	1·1	4·3	....	4·3	....	....
31	1·25	6·5	....	....	1·05	3·6	....	4·3	....	....

Daily Gauge Heights and Discharges of Hefferly Creek at Upper Station for 1913.

Day.	May.		June.		July.		August.		September.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	....	1·2	5·7	1·2	5·7	....	1·8	1·5	17·9
2	....	....	1·3	9·2	1·15	4·4	1·05	2·2	1·5	17·9
3	....	....	1·25	7·4	1·15	4·4	....	1·8	1·45	15·6
4	....	....	1·2	5·7	1·15	4·4	1·0	1·4	1·5	17·9
5	....	....	1·25	7·4	1·1	3·1	1·0	1·4	1·45	15·6
6	....	....	....	8·3	1·1	3·1	1·0	1·4	1·4	13·2
7	....	....	1·3	9·2	1·05	2·2	1·45	15·6	1·4	13·2
8	....	....	1·3	9·2	1·0	1·4	1·6	23·2	1·4	13·2
9	....	....	1·3	9·2	0·95	1·0	1·55	20·5	1·35	11·2
10	....	....	1·2	5·7	0·95	1·0	1·5	17·9	1·35	11·2
11	1·25	7·4	1·25	7·4	1·0	1·4	1·4	13·2	1·35	11·2
12	1·25	7·4	1·25	7·4	0·95	1·0	1·45	15·6	1·3	9·2
13	1·3	9·2	1·25	7·4	0·95	1·0	1·4	13·2	1·3	9·2
14	1·25	7·4	1·25	7·4	1·0	1·4	1·4	13·2	1·3	9·2
15	1·25	7·4	1·25	5·7	1·0	1·4	1·4	13·2	1·3	9·2
16	1·25	7·4	1·25	7·4	1·0	1·4	1·4	13·2	1·1	3·1
17	1·2	5·7	1·25	7·4	1·0	1·4	....	12·2	1·0	1·4
18	1·2	5·7	1·2	5·7	1·0	1·4	1·35	11·2	0·9	0·5
19	1·2	5·7	1·25	7·4	1·0	1·4	1·35	11·2	0·9	0·5
20	1·2	5·7	1·2	5·7	....	1·4	1·35	11·2	....	....
21	1·2	5·7	1·2	5·7	1·0	1·4	1·35	11·2	....	....
22	1·2	5·7	1·25	7·4	1·0	1·4	1·3	9·2	....	....
23	1·15	4·4	1·2	5·7	1·0	1·4	1·3	9·2	....	....
24	1·2	5·7	....	5·1	....	1·2	....	9·2	....	....
25	1·2	5·7	1·15	4·4	0·95	1·0	1·3	9·2	....	....
26	1·2	5·7	1·3	9·2	....	2·0	1·3	9·2	....	....
27	....	5·7	1·25	7·4	1·1	3·1	1·3	9·2	....	....
28	1·2	5·7	1·25	7·4	1·1	3·1	1·3	9·2	....	....
29	1·2	5·7	....	6·8	1·05	2·2	....	11·2	....	....
30	1·2	5·7	....	6·2	1·05	2·2	....	13·4	....	....
31	1·25	7·4	....	....	1·0	1·4	....	15·8	....	....

DAILY GAUGE HEIGHTS AND DISCHARGES of Hefferly Creek at Crawshaw's Ditch for 1913.

Day.	May.		June.		July.		August.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	....	0·4	2·6	0·25	1·4	....	2·8
2	....	....	0·4	2·6	0·3	1·8	0·45	3·0
3	....	....	0·4	2·6	0·3	1·8	....	2·8
4	....	....	0·35	2·2	0·3	1·8	0·4	2·6
5	....	....	0·4	2·6	0·25	1·4	0·35	2·2
6	....	....	....	2·8	0·25	1·4	0·35	2·2
7	....	....	0,45	3·0	0·2	1·0	0·5	3·5
8	....	....	0·45	3·0	0·15	0·7	0·5	3·5
9	....	....	0·45	3·0	0·2	1·0	0·0	0·0
10	....	....	0·45	3·0	0·15	0·7	....	0·0
11	....	....	0·45	3·0	0·0	0	....	....
12	....	....	0·5	3·5	0·0	0	....	....
13	0·35	2·2	0·5	3·5	0·15	0·7	....	....
14	0·35	2·2	0·5	3·5	0·15	0·7	....	....
15	0·35	2·2	0·5	3·5	0·1	0·4	....	....
16	0·3	1·8	0·5	3·5	0·0	0·0	....	....
17	0·25	1·4	0·5	3·5	....	0·0	....	....
18	0·3	1·8	0·5	3·5	....	0·0	....	....
19	0·3	1·8	0·5	3·5	....	0·0	....	....
20	0·3	1·8	0·5	3·5	....	0·0	....	....
21	0·3	1·8	0·5	3·5	....	0·0	....	....
22	0·3	1·8	0·5	3·5	....	0·0	....	....
23	0·4	2·6	0·5	3·5	....	0·0	....	....
24	0·4	2·6	0·5	3·5	....	0·0	....	....
25	0·4	2·6	0·5	3·5	....	0·0	....	....
26	0·4	2·6	0·3	1·8	....	0·0	....	....
27	0·4	2·6	0·3	1·8	....	0·0	....	....
28	0·4	2·6	0·25	1·4	0·5	3·5	....	....
29	0·4	2·6	....	1·4	0·45	3·0	....	....
30	0·4	2·6	....	1·4	0·45	3·0	....	....
31	0·3	1·8	....	....	0·4	2·6	....	....

INGRAM CREEK NEAR ADELPHI.

Location.—Section 23, township 17, range 13, 3 miles east of Adelphi (Grand Prairie).

Records Available.—April 1, 1911, to October 4, 1911; April 1, 1912, to August 31, 1912; April 1, 1913, to September 16, 1913.

Winter Conditions.—There are generally some severe cold spells, and snowfall is usually light.

Gauge.—The gauge is a vertical staff gauge and daily readings are taken during the irrigation season by Miss Mildred King.

Discharge Measurements.—The stream is well rated by measurements covering the stream's range (made during 1911-12-13.)

Accuracy.—The gauge readings were accurately made and the general accuracy is high.

INGRAM CREEK.

Ingram creek rises in the Bouleau hills just south of Grand Prairie, at an elevation of about 4,000 feet, and flows into Salmon river, in township 17, range 13, west of the 6th meridian, 3 miles east of Grand Prairie village, at an elevation of about 1,800 feet. The creek is about 9 miles long, and drains an area of 25 square miles. The drainage area is a broken plateau extending southerly from the bowl-shaped Grand Prairie to the Bouleau hills, which separate Ingram creek and

Salmon river from Okanagan divide. About 7 miles from the mouth of Ingram creek there is a meadow, called Homfray's meadow, which could be used as a reservoir in which to store the surplus waters of the May floods. At Homfray's meadow the creek has an abrupt turn from the east, and about a mile from this turn the creek divides into two forks. On the north fork there are two meadows which might be suitable for storage reservoirs. These are Wolf's and Johnston's meadows. On account of improvements on Wolf's meadow or homestead, Johnston's meadow might be the only site available for storage, unless the economic value of the stored water in Homfray's and Wolf's meadow for use in the valuable Grand Prairie lands be considered greater than the said meadows for actual cultivation.

The mean annual precipitation in Grand Prairie and the Ingram Creek drainage is about 12 inches. Irrigation is necessary and the waters of Ingram creek are extremely valuable for irrigation purposes. Some of the water is now used on the Ingram estate and neighbouring lands at the mouth of the stream, but by far the greater proportion of the flood water of May and June run to waste into Salmon river.

There are some six old provincial water records from Ingram creek, the first one dated (1871) being appurtenant to the Ingram estate, and practically controlling the natural flow of the stream during the latter part of the irrigation season.

The run-off of Ingram creek has been studied during the open season of 1911, 1912 and 1913. A station was established a short distance above the mouth and all irrigation diversions. Meter measurements were taken and daily records of gauge heights. The resulting hydrographic data for the periods, April 1 to September 30, 1911, and April 1 to September 1, 1912, are appended. The year 1911 was a dry year throughout nearly the whole dry belt. The maximum discharge of Ingram creek took place on May 17, 1911, and was 52 cubic feet per second (gauge height 1·64 feet.) The minimum flow occurred September 19, and was 0·5 c.f.s., with a gauge height of 0·3 feet. The totalr un-off from April 1 to September 30, was a little over 3,000 acre-feet. The flow prior to April 1, and later than September 30, was very small, being less than 1 c.f.s.

The year 1912, had a much larger run-off. The maximum discharge took place again on May 17, and was 130 c.f.s., with a gauge height of 2.15 feet. The minimum recorded stage was on August 9, being 3·0 c.f.s. at the gauge height of 0·65 feet. The total run-off from April 1 to September 1, 1912, was 7,000 acre-feet.

The maximum recorded stage for 1913, of 165 c.f.s. occurred on May 16, and the minimum of 5·0 on September 6.

Discharge Measurements of Ingram Creek near Grand Prairie, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1911			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec. ft.
May 24	C. E. Richardson	1,048	18	20·3	1·88	1·51	38·2
May 24	C. G. Cline	1,046	18	19·6	1·86	1·51	36·5
June 6	W. M. Carlyle	1,044	15	8·2	0·95	1·015	7·9
July 12	do	1,044	14	9·1	0·64	0·90	5·9
July 26	do	1,044	7	2·9	0·93	0·62	2·7
Aug. 23	do	1,044	5	2·0	0·74	0·46	1·5
1912.							
May 12	C. .E Richardson	1,048	18	18·5	3·08	1·68	57·0
July 16	do	1,048	5	4·7	1·28	0·82	6·0
April 23	H. J. E. Keys	1,057	18	7·3	2·10	1·18	15·1
June 28	do	1,057	14	8·5	1·50	1·12	12·9

Monthly Discharge of Ingram Creek near Grand Prairie for 1913.

(Drainage area, 25 square miles.)

Month.	Discharge in Second-Feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
April	47·0	8·0	19·9	0·80	0·89	1,180
May	165·0	18·0	93·5	3·70	4·27	5,790
June	81·5	20·5	41·4	1·66	1·85	2,460
July	81·5	9·5	28·7	1·15	1·33	1,760
August	9·5	5·0	6·6	0·26	0·30	406

Daily Gauge Heights and Discharges of Ingram Creek near Grand Prairie for 1913.

Day.	April.		May.		June.		July.		August.		September.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	8·0	1·4	27·5	1·8	74·0	1·6	47·0	1·05	9·5	0·9	6·0
2	....	8·0	1·35	24·0	1·7	60·0	1·5	36·5	1·0	8·0	0·9	6·0
3	....	8·0	1·3	20·5	1·6	47·0	1·5	36·5	1·0	8·0	0·9	6·0
4	....	8·0	1·35	24·0	1·5	36·5	1·5	36·5	1·0	8·0	1·0	8·0
5	....	8·0	1·35	24·0	1·55	41·5	1·55	41·5	0 9	6 0	0 9	6·0
6	....	11·0	1·35	24·0	1·5	36·5	1·55	41·5	0·9	6·0	0·9	6·0
7	....	11·0	1·3	20·5	1·5	36·5	1·5	36·5	0·95	7·0	0·9	6·0
8	....	11·0	1·25	18·0	1·5	36·5	1·45	32·0	1·0	8·0	0·85	5·5
9	....	11·0	1·4	27·5	1·5	36·5	1·4	27·5	1·0	8·0	0·85	5·5
10	....	11·0	1·8	74·0	1·4	27·5	1·4	27·5	0·9	6·0	0·9	6·0
11	....	15·5	2·0	104·0	1·3	20·5	1·3	20·5	0·9	6·0	0·9	6·0
12	....	15·5	2·0	104·0	1·8	74·0	1·4	27·5	0·9	6·0	0·9	6·0
13	....	15·5	2·2	135·0	1·85	81·5	1·6	47·0	0·9	6·0	0·85	5·5
14	....	15·5	2·25	142·0	1·6	47·0	1·7	60·0	0·9	6·0	0·85	5·5
15	....	15·5	2·4	165·0	1·6	47·0	1·85	81·5	0·9	6·0	0·8	5·0
16	1·3	20·5	2·4	165·0	1·4	27·5	1·55	41·5	0·9	6·0	0·8	5·0
17	1·3	20·5	2·3	150·0	1·3	20·5	1·4	27·5	0·95	7·0	....	....
18	1·5	36·5	2·25	142·0	1·4	27·5	1·3	20·5	1·0	8·0	....	....
19	1·6	47·0	2·2	135·0	1·4	27·5	1·3	20·5	1·0	8·0	....	....
20	1·5	36·5	2·2	135·0	1·4	27·5	1·2	15·5	1·0	8·0	....	....
21	1·6	47·0	1·95	96·5	1·4	27·5	1·3	20·5	0·8	5·0	....	....
22	1·5	36·5	1·95	96·5	1·3	20·5	1·3	20·5	0·8	5·0	....	....
23	1·4	27·5	2·0	104·0	1·3	20·5	1·3	20·5	0·9	6·0	....	....
24	1·4	27·5	2·1	120·0	1·65	53·5	1·2	15·5	0·9	6·0	....	....
25	1·3	20·5	2·1	120·0	1·7	60·0	1·15	13·0	0·9	6·0	....	....
26	1·3	20·5	2·2	135·0	1·7	60·0	1·1	11·0	0·9	6·0	....	....
27	1·25	18·0	2·3	150·0	1·6	47·0	1·1	11·0	0·85	5·5	....	....
28	1·3	20·5	2·2	135·0	1·5	36·5	1·2	15·5	0·9	6·0	....	....
29	1·3	20·5	2·0	104·0	1·5	36·5	1·2	15·5	0·9	6·0	....	....
30	1·35	24·0	1·9	89·0	1·6	47·0	1·1	11·0	0·9	6·0	....	....
31	....	....	1·9	89·0	....	....	1·05	9·5	0·95	7·0	....	....

JACKO CREEK.

Location.—Section 5, township 19, range 18, west 6th meridian.

Records Available.—May 1 to September 30, 1912; May 7 to August 31, 1913.

Winter Conditions.—Stream is usually dry by the middle of September, and commences to flow in April. Light snowfall.

Gauge.—Vertical staff gauge read tri-weekly by Muir Watson.

Channel.—The bed of the stream is gravelly, and the channel is about 5 feet in width. A maximum flow of 15 second-feet was recorded on May 16, 1912.

Discharge Measurements.—Five discharge measurements give a fairly well-defined curve.

Accuracy.—The accuracy of returns is fair and results are thought to be within 10 per cent of true conditions.

JACKO CREEK.

Jacko creek has its source in the hills 20 miles south of Kamloops, at an elevation of 3,800 feet, and discharges into Jacko lake near Kamloops at an elevation of 2,200 feet. It is part of the Peterson-Thompson drainage. The drainage area, as measured from the Geological Survey map, dated 1895, scale 2 miles to 1 inch, is 13 square miles. Three small unnamed creeks enter from the right, going upstream. Jacko creek is a small but very contentious irrigation stream in the most arid section of the dry belt. The summers are hot and dry, the winters long and cold (-30° F.).

Jacko creek, rising in a swamp, descends rapidly for about 6 miles through a densely wooded country, where it flows sluggishly through irrigable land to Jacko lake. The water in Jacko creek is subject to the records on Jacko lake and Peterson creek, of which it is the chief tributary. (See Peterson creek for further information.) In 1911 and for the preceding four years, no water reached Jacko lake; this fact formed the basis of bitter fights in the courts. From observations made in 1912, it appears that there is an enormous loss of water due to seepage. With a discharge of 7 second-feet at the gauging station, there was no more than 2 second-feet lower down, all the irrigation ditches being closed.

The river station on Jacko creek was established above all diversions on May 1, 1912, by H. J. E. Keys. The measuring section is located about 100 feet above the Watson diversion, and 100 yards west of the Kamloops-Trout lake road. A standard vertical staff gauge is located on the right bank at the measuring section. All measurements were made by wading. This is an excellent measuring section; with good control; high banks, uniform current and one permanent channel.

The datum of the gauge is referred to one bench mark.

Discharge Measurements of Jacko Creek, near Kamloops 1911-12-13.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
1911.							
June 8......	W. M. Carlyle..............	1,044	2·7	1·4	0·35	1·0	0·5
1912.							
May 18......	H. J. E. Keys..............	1,057	7·0	6·1	1·17	2·0	[1]7·2
" 29......	do	1,057	5·0	5·0	0·64	1·8	3·2
July 11......	do	1,057	3·0	1·2	0·50	1·42	0·5
1913.							
May 29......	do	1,057	4·5	4·2	0·7	1·81	3·0
Aug. 31......	do	1,057	....	....	....	0·0	0·0

Note.—[1] New gauge.

Monthly Discharge of Jacko Creek, near Kamloops for 1913.

(Drainage area, 13 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May	7·0	2·0	3·3	0·25	0·29	203
June	3·0	0·8	1·99	0·15	0·17	118
July	3·0	0·2	0·99	0·08	0·09	61
August	0·2	0·0	0·1	0·01	0·02	6

Daily Gauge Heights and Discharges of Jacko Creek above all diversions for 1913.

Day.	May.		June.		July.		August.	
	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	....	....	3·0	1·8	3·0	....	0·2
2	....	....	1·8	3·0	....	2·5	....	0·2
3	....	....	....	2·5	1·7	2·0	....	0·1
4	....	....	1·7	2·0	....	1·6	0·9	0·1
5	....	....	....	2·0	1·6	1·3	....	0·1
6	....	....	....	2·0	....	1·3	0·6	0·1
7	1·7	2·0	1·7	2·0	1·6	1·3	....	0·1
8	....	2·5	....	2·0	....	1·1	0·6	0·1
9	1·8	3·0	1·7	2·0	1·5	0·8	....	0·1
10	1·9	4·5	....	2·0	....	0·8	....	0·1
11	....	5·7	1·7	2·0	....	0·8	0·6	0·1
12	2·0	7·0	....	1·8	1·5	0·8	....	0·1
13	....	7·0	....	1·5	....	1·1	1·0	0·1
14	2·0	7·0	1·6	1·3	1·6	1·3	....	0·1
15	....	5·7	....	1·3	....	1·3	....	0·1
16	1·9	4·5	1·6	1·3	1·6	1·3	1·0	0·1
17	....	4·5	....	1·0	....	1·1	....	0·2
18	....	4·5	1·5	0·8	....	0·9	1·3	0·2
19	1·9	4·5	....	1·0	1·5	0·8	....	0·2
20	....	3·8	....	1·2	....	0·8	1·2	0·2
21	1·8	3·0	1·6	1·3	1·5	0·8	....	0·2
22	....	3·0	....	1·3	....	0·6	1·0	0·1
23	....	3·0	1·6	1·3	1·4	0·4	....	0·1
24	1·8	3·0	....	2·1	....	0·4	....	0·1
25	....	3·8	1·8	3·0	....	0·4	0·8	0·1
26	1·9	4·5	....	3·0	1·4	0·8	....	0·1
27	....	3·8	....	3·0	....	0·4	dry	0·0
28	1·8	3·0	1·8	3·0	1·4	0·4	....	....
29	....	3·0	....	3·0	....	0·3	....	....
30	1·8	3·0	1·8	3·0	1·3	0·2	....	....
31	....	3·0	....	....	1·3	0·2	....	....

JAMIESON CREEK.

Location.—Section 21, township 22, range 17, west 6th meridian.

Records Available.—June 20 to October 30, 1911; April 3 to October 30, 1912; May 6 to October 1, 1913; and numerous float measurements by the courtesy of Arthur E. Meighan, C. E., General Manager British Columbia Fruitlands Company, made during 1907, 1908, and 1909.

Winter Conditions.—Jamieson creek is usually frozen up during December, January, and February, and the run-off in November and March is very small.

Gauge.—Vertical staff gauge installed above the diversion of the British Columbia Fruitlands Company. It is read daily by E. Sutton during the open period.

Channel.—Channel is about 30 feet in width, with muddy and rocky bottom. Discharge varies from zero to a maximum of 500 cubic feet at normal high water. Mr. Meighan records a flow of 1,400 second-feet following a cloudburst on May 19, 1907.

Discharge Measurements.—The returns submitted are compiled from a well-defined curve, meterings having been made at all stages of flow.

Accuracy.—The accuracy on the whole is high and results are considered to be well within 10 per cent of actual conditions.

JAMIESON CREEK.

Jamieson creek has its source in the hills north of the Tranquille Forest reserve, outside the Railway Belt, at an elevation of 5,000 feet. It discharges into the North Thompson river from the west, 18 miles north of Kamloops, at an elevation of 1,170 feet. It is part of the North Thompson drainage. The area of the watershed is 66 square miles. The creek is in the dry belt, and the water is used for irrigation. The mean annual precipitation is from 10 to 12 inches. Owing to the influence of the valley of the North Thompson river, the climate is a little cooler than at Kamloops and the snow remains on the ground much longer in the winter.

The water of Jamieson creek is used by the British Columbia Fruitlands Company for the irrigation of their lands along the North Thompson and the main Thompson rivers. The intake is situated about a mile from the mouth of the creek. Water has been used from Jamieson creek for this purpose for a number of years, but a new canal and flume line has recently been constructed by the company to replace the old system. The canal is lined with concrete to prevent seepage. When necessary, galvanized steel fluming has been used and one inverted syphon of 48 inches diameter has been constructed of wood stave pipe. The main system is about 15 miles long, and will serve some 6,000 acres of the company's land.

The British Columbia Fruitlands Company, have constructed a storage dam on Wentworth lake, near the head of the creek, but small storage has been secured.

The main station on Jamieson creek is 100 feet above the British Columbia Fruitlands dam, and measures the total flow of the stream. It was established June 20, 1911, and gauge readings were taken till October 31, 1911, from April 3 to October 31, 1912, and from May 6 to October 1, 1913. The gauge is a 5 foot cedar staff nailed to tree stump on the left bank of the stream, 100 feet above the British Columbia Fruitlands Company's dam. Its datum is referred to three permanent bench-marks. The meter measurements were made by wading at a section 25 feet below the gauge. The channel is straight for 25 feet above the section, and the water swift. There is a straight channel for 75 feet below the section, with riffles and then the dam crest. The right bank is a rock cliff 100 feet high. The left bank is 3 feet high and covered with bushes, but is not likely to overflow. There is a gravel bar in the bed itself which at a certain stage divided the creek into two branches near the gauge. This occurs at a gauge height of 3·0 for a range of about 0·6 feet. Above that stage the water flows over the bar, and the stream becomes one; below the stage the second stream stops running. The gauge is only about 100 feet above the dam, and although there is considerable fall in that distance the engineer

should note particularly each trip that no change has been made at the dam to affect the height of the water at the gauge, and that there are still riffles between the gauge and the dam.

A second station was established below the dam to show the amount of unused water and to give some idea of the water diverted by the British Columbia Fruitlands ditch. It was found, however, that there was considerable loss by seepage from the stream into the gravel beds between the two stations. Hence the amount of unused water is larger than the figures given by lower station; the amount of water diverted cannot be found by comparing the surface flow at the two stations. Gauge readings were taken at the lower station, from June 22, 1911, when the station was established, to October 30, 1911; and from April 3 to July 12, 1912. The gauge readings at this station will not be continued another season.

Discharge Measurements of Jamieson's creek near Upper station, 1911-1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
1911.							
June 20	C. G. Cline	1,046	24	27·6	2·21	2·35	61·10
Aug. 20	do	1,046	19	13·2	0·64	1·78	8·43
Oct. 7	C. K. Smith	1,046	20	15·0	0·51	1·82	7·66
1912.							
June 21	H. J. E. Keys	1,046	....	14·5	1·77	2·30	[1]57·50
July 8	do	1,057	23	31·1	1·79	2·33	55·70
1913.							
June 11	do	1,057	26	26·2	3·50	2·65	[2]103·00
July 16	do	1,057	31	57·1	2·80	2·88	167·00

Note.—[1] Sum of diversions and discharge at Lower station.
[2] Different section.

Monthly Discharge of Jamieson Creek near Black Pine P. O. for 1913.

(Drainage area, 66 square miles.)

Month.	Discharge in Second-Feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May	530	140	295	4·47	5·15	18,100
June	295	69	148	2·25	2·51	8,810
July	123	40	85	1·29	1·49	5,230
August	103	45	74	1·12	1·29	4,550
September	77	12	40	0·61	0·68	2,380

Daily Gauge Heights and Discharges of Jamieson Creek, near Black Pine, P. O., for 1913.

Date.	May.		June.		July.		August.		September.		October.	
	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.
1	......	140	......	265	......	123	......	82	2·2	40	1·95	15
2	......	150	3·2	240	2·6	103	......	83	......	47	......	......
3	......	160	......	215	......	71	......	84	2·3	54	......	......
4	......	170	3·0	190	2·2	40	2·5	85	......	61	......	......
5	......	180	......	130	......	61	......	77	2·4	69	......	......
6	3·0	190	2·4	69	......	82	2·4	69	......	59	......	......
7	......	200	......	94	2·6	103	......	69	......	50	......	......
8	3·1	215	......	120	......	86	2·4	69	2·2	40	......	......
9	......	325	2·8	143	2·4	69	......	64	......	34	......	......
10	3·9	440	......	132	......	77	......	59	2·1	28	......	......
11	......	440	2·7	122	2·5	85	2·3	54	......	34	......	......
12	3·9	440	......	105	......	87	......	69	2·0	40	......	......
13	......	380	2·5	85	......	89	2·5	85	......	50	......	......
14	3·5	325	......	91	......	91	......	85	......	60	......	......
15	......	310	......	97	......	93	2·5	85	2·45	77	......	......
16	3·4	295	2·6	103	......	95	......	91	......	65	......	......
17	......	295	......	94	......	97	......	97	2·3	54	......	......
18	3·4	295	2·5	85	......	99	2·6	103	......	47	......	......
19	......	320	......	105	......	100	......	103	2·2	40	......	......
20	3·6	350	2·7	122	......	101	2·6	103	......	36	......	......
21	......	370	......	129	2·6	103	......	93	......	32	......	......
22	......	390	......	136	......	94	......	83	2·1	28	......	......
23	3·8	410	2·8	143	2·5	85	......	73	......	25	......	......
24	......	450	......	154	......	77	......	63	2·05	23	......	......
25	......	490	2·9	166	2·4	69	2·3	54	......	21	......	......
26	4·2	530	......	230	......	70	......	54	2·0	19	......	......
27	......	470	3·4	295	......	72	2·3	54	......	17	......	......
28	3·8	410	......	245	......	74	......	54	......	15	......	......
29	......	370	......	195	......	76	2·3	54	1·9	12	......	......
30	3·5	325	2·8	143	......	78	......	49	......	13	......	......
31	......	295	......	......	......	80	......	45	......	......	......	......

LOUIS CREEK AT NORTH BOUNDARY OF RAILWAY BELT.

Location.—Section 33, township 23, range 15, west 6th meridian at Leslie's ranch.

Records Available.—July 16, to October 31, 1911; April 1 to November 16, 1912; May 1 to October 14, 1913.

Winter Conditions.—Not very severe, but with occasionally heavy snowfall. Open conditions often exist throughout the year.

Gauge.—Standard vertical staff gauge read daily during 1911 and 1912 and tri-weekly during 1913.

Channel.—The width of the stream varies from 25 to 35 feet, the control is good and the station on the whole excellent.

Accuracy.—Gauge readings were carefully made and the accuracy of returns is fairly high (within 10 per cent.)

LOUIS CREEK.

Louis creek has its source in the Niskonlith creek divide township 21, range 14, west 6th Meridian, at an elevation of 3,100 feet, and discharges into the North Thompson, 36 miles north of Kamloops from the east, at an elevation of 1,160 feet. It is part of the Thompson drainage; the drainage area, as measured from the Geological Survey map, dated 1895, scale 2 miles to 1 inch, is 180 square

miles. Of this area, 100 square miles is above the river station. Louis creek has a small industrial water-power, and is used a little for irrigation purposes near the mouth in the North Thompson valley. The ranchers in the Louis Creek valley don't require any irrigation except in very dry years, as the stream is almost entirely outside the dry belt. It is probable that the mean annual precipitation is from 15 to 25 inches. The valley is bounded by high precipitous mountains; heavily timbered, whose snow feeds the creek as well as its tributaries Fadear, Cahilty, and McGillivary creeks, entering from the east and Christian creek from the west near the headwaters. There is a small sawmill at the mouth operated by power from the creek, and similar industrial powers would be possible on the lower 5 miles of the stream, where the stream falls rapidly, in contrast to its sluggishness in its upper 20 miles. The tributaries of Louis creek also have good power possibilities and should a market arise, would warrant a thorough investigation.

The river station on Louis creek was established on Ausust 16, 1911, by C. G. Cline. It is located at a bridge on the Leslie ranch, 2 miles south of the Railway Belt boundary, and about 12 miles from the mouth. The purpose of this location was to determine the amount of Louis creek water rising in the Railway Belt. A standard vertical staff gauge, 7 feet long, is located on the right bank 50 feet above the aforementioned bridge, and its datum referred to three benchmarks. The measuring section is at the bridge; in low water the measurements are made by wading, in high water by means of a cable from the bridge. This is a good section, the control is fair, the current uniform, the banks high, and one permanent channel.

Louis Creek—Undershot Wheel and Sawmill.

DISCHARGE MEASUREMENTS of Louis Creek, at Leslie's Ranch, 1911-12, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq.-ft.	Ft. per sec.	Feet.	Sec.-ft.
Aug. 16-12....	C. G. Cline..................	1,046	25	33·4	0·80	0·91	28
Sept. 11-11....	do	1,046	26	36·8	0·96	0·98	35·4
Apr. 30-12....	Cline & Dann................	1,046	26	49·4	1·7	1·50	94
May 16-12....	E. M. Dann..................	1,044	31	108·2	4·0	3·80	439
May 29-12....	do	1,044	28	90	3·6	3·20	328
June 8-12....	do	1,044	28	82	3·4	2·72	276
June 9-12....	do	1,044	28	85	3·4	2·81	288
Aug. 22-12....	H. J. E. Keys...............	1,057	30	19	2·8	1·02	52[1]
June 28-13....	do	1,057	33	58	2·65	2·10	155

NOTE.—[1]Different M. Section.

MONTHLY DISCHARGE of Louis Creek at Leslie's Ranch, for 1913.

(Drainage area, 100 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May....................................	398	50	172	1·72	1·98	10,600
June....................................	454	144	250	2·50	2·79	14,900
July....................................	165	57	98	0·98	1·13	6,025
August....................................	65	42	54	0·54	0·62	3,320
September....................................	48	38	42	0·42	0·47	2·500

Daily Gauge Heights and Discharges of Louis Creek at Leslie's Ranch, for 1913.

Day.	April.		May		June.	
	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	....	....	50	3·6	406
2	....	....	1·0	50	3·9	454
3	....	....	....	50	....	450
4	....	....	....	50	....	446
5	....	....	1·0	50	3·2	342
6	....	....	....	60	3·0	310
7	....	....	....	70	....	323
8	....	....	....	80	....	336
9	....	....	1·45	89	3·25	350
10	....	....	2·0	158	....	308
11	....	....	....	162	....	279
12	....	....	2·05	165	2·6	246
13	....	....	....	158	2·4	215
14	....	....	....	151	2·35	208
15	....	....	....	144	2·15	179
16	....	....	1·85	137	2·2	186
17	....	....	....	139	2·25	193
18	....	....	....	141	1·9	144
19	....	....	1·9	144	2·2	186
20	....	....	....	158	2·15	179
21	....	....	....	172	2·1	172
22	....	....	....	186	2·3	200
23	....	....	2·3	200	2·2	186
24	....	....	....	230	2·1	172
25	....	....	....	260	2·15	179
26	....	....	....	290	2·15	179
27	....	....	....	325	2·1	172
28	1·05	54	3·3	358	2·1	172
29	....	....	....	354	2·05	165
30	....	....	3·25	350	1·95	151
31	....	....	3·55	398	....	....

Daily Gauge Heights and Discharges of Louis Creek at Leslie's Ranch for 1913—*Concluded.*

Day.	July.		August.		September.		October.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	1·95	151	1·1	57	0·8	40	....	....
2	1·85	137	1·05	54	....	42	....	....
3	1·85	137	....	58	....	44	0·8	40
4	1·7	117	1·15	61	....	46	....	....
5	1·6	105	....	60	0·95	48	....	....
6	1·5	94	....	58	....	47	0·75	38
7	1·55	100	....	56	....	46	....	....
8	1·5	94	1·05	54	0·9	45	....	....
9	1·4	84	....	52	....	44	....	....
10	1·4	84	....	50	....	43	0·8	40
11	1·5	94	0·95	48	....	42	....	....
12	1·5	94	....	48	0·8	40	....	....
13	1·5	94	....	49	....	41	1·15	61
14	1·95	151	....	49	....	42	....	....
15	2·05	165	1·0	50	0·85	43	....	....
16	2·0	158	....	55	....	43	....	....
17	....	141	....	60	....	43	....	....
18	....	124	1·2	65	....	43	....	....
19	....	107	....	64	0·85	43	....	....
20	1·45	89	....	63	....	43	....	....
21	1·4	84	....	62	....	43	....	....
22	1·4	84	1·15	61	0·85	43	....	....
23	1·3	74	....	57	....	42	....	....
24	1·15	61	....	53	....	41	....	....
25	....	61	0·95	48	....	40	....	....
26	....	61	....	48	0·75	38	....	....
27	....	61	....	48	....	38	....	....
28	1·15	61	....	48	....	38	....	....
29	1·1	57	0·95	48	0·75	38	....	....
30	....	57	....	45	....	38	....	....
31	....	57	....	42	....	....	....	....

MONTE CREEK (ABOVE BOSTOCK'S DIVERSION.)

Location.—Section 25, township 19, range 15, west 6th meridian.

Records Available.—May 20 to June 30, 1911; August 8, 1911; April 8, 1911; to September 7, 1912; April 16 to September 13, 1913.

Winter Conditions.—Monte creek is frozen up as a general rule during December, January, and February, while the flow is very small during October and November. Snowfall is light though there are sometimes short periods of severe cold during the winter.

Gauge.—Standard vertical staff gauge read semi-weekly by T. F. Teagle during the irrigation season.

Channel.—The channel is about 15 feet in width and the bed rocky. The flow varies from zero to 100 cubic feet per second during high freshet; 117 cubic feet per second is the highest flow recorded, which occurred on May 18, 1912.

Discharge Measurements.—The gauge-height discharge curve is well defined.

Accuracy.—Accuracy of results submitted is high.

MONTE CREEK.

Monte creek is a stream about 20 miles long rising in Monte hills, 5 miles west of Grand Prairie, at an elevation of 4,000 feet and, flowing northerly, discharges into the South Thompson river at Ducks, B.C. It is a stream about 6 feet wide and from 1 foot to 2 feet deep, with a mean velocity of from 4 to 5 feet per second. This stream flows through an agricultural district in the dry

belt and is a very contentious irrigation stream. Senator Bostock, a large land owner in this vicinity, irrigates hundreds of acres of land in the Monte Creek Valley, and also bench and bottom lands in the Thompson river valley near the mouth of the creek. Records on this creek are held to divert water from Monte creek at a point about 15 miles from the mouth, Summit lake, where it is stored and used when required on lands near Grand Prairie in the Salmon river drainage area. In 1912 there was plenty of water for all concerned, but in previous years considerable trouble arose, due to the scarcity of water. There is a small storage reservoir near the source of Monte creek, with a capacity of 2,000 acre-feet.

The precipitation is about 12 inches throughout the valley, of which about 4 inches is snow. The winters are short and cold and the summers hot and dry. The creek freezes up during the months of December, January, and February.

Regular gauging stations were established on Monte Creek: (1) Above Bostock's diversion, (2) below diversions to Summit lake, (3) diversions to Summit lake.

The station on Monte creek above Bostock's diversion was established on May 20, 1911, by C. E. Richardson. The measuring section is located 300 yards above the Bostock headgate, 1½ miles from Ducks, and 100 yards from the wagon road from Ducks to Grand Prairie.

The gauge is a standard vertical staff near the measuring section on the right bank of the stream. Measurements were made by wading with Price electric current meter. The channel above and below the station is straight for 50 ft., the water is fairly fast. The right bank is steep for 15 feet to the wagon road. The left bank is low and heavily timbered, but there is no change of overflow. The bed of the stream is silt at the measuring section and gravel at the gauge. There is only one channel and its depth is from 1′ to 3′. Three bench marks were established and referred to the gauge datum.

The station on Monte Creek below the diversion to Summit lake was establised on May 25, 1911, by C. E. Richardson. The measuring section is 100 yards below the diversion near T. Graham's and ½ mile west of the Grand Prairie-Monte creek wagon road, 6 miles from Grand Prairie. The gauge is a vertical staff 4″ x 1½″ x 4′. (cedar) marked in feet and tenths from 3′ to 7.′7 fastened to the right bank of the stream 100 yds. below the diversion. Measurements are made with Price electric current meter and wading equipment. The channel above and below the station is straight for 100 feet and the water flows with a uniform velocity. The banks are steep and high and sparsely timbered. The bed of the stream is gravelly; there is only one channel with a depth of from 6″ to 2. 5″ . Three bench marks were established and referred to the gauge datum.

Discharge Measurements of Monte Creek above Bostock's diversion, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913.		Feet.	Sq.-ft.	Ft. per sec.	Feet.	Sec.-ft.	
Apr. 22	H. J. E. Keys	1057	13·0	12·9	1·3	1·35	17·5
June 17	do	1057	14·0	8·1	1·4	1·23	11·4[1]

Note.—[1]Different measuring section.
Gauge Reader—T. F. Teagle.

Monthly Discharge of Monte Creek above Bostock's diversion for 1913.

(Drainage area, 110 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May	44	11	30	·27	·31	1,845
June	41	11	18·1	·16	·18	1,077
July	7·9	2·3	4·2	·04	·05	258
August	2·7	1·6	2·3	·02	·02	141

Note.—The flow through the diversion into Summit lake has not been included in above.—

Daily Gauge Heights and Discharges of Monte Creek, above Bostock's diversion for 1913.

Day.	April.		May.		June.		July.		August.		September.	
	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	....	....	20	....	23	1·1	7·2	....	2·5	....	1·6
2	....	....	1·3	15·3	....	20	....	7·4	0·82	2·7	....	1·6
3	....	....	....	14	....	18	....	7·6	....	2·6	0·67	1·6
4	....	....	....	13	1·3	15·3	....	7·8	....	2·5	....	1·6
5	....	....	....	12	....	14	1·12	7·9	....	2·4	....	1·7
6	....	....	....	11	....	13	....	7·0	0·79	2·4	0·7	1·7
7	....	....	1·2	10·5	1·25	12·7	....	6·1	....	2·4	....	1·7
8	....	....	....	17	....	12	....	5·2	....	2·5	....	1·6
9	....	....	....	24	....	11	....	4·3	0·8	2·5	....	1·5
10	....	....	1·5	30·0	....	10	0·9	3·6	....	2·5	0·65	1·5
11	....	....	....	34	1·2	10·5	....	3·7	....	2·5	....	1·5
12	....	....	....	38	....	11	....	3·8	....	2·5	....	1·6
13	....	....	....	41	....	12	0·92	3·9	0·8	2·5	0·67	1·6
14	....	....	1·65	44·0	1·25	12·7	....	4·1	....	2·5	....	....
15	....	....	....	41	....	12·7	....	4·3	....	2·6	....	....
16	1·49	29·2	....	38	....	12·7	0·97	4·6	0·82	2·7	....	....
17	....	27·0	1·57	36·3	....	12·7	....	4·2	....	2·6	....	....
18	....	25·0	....	36	1·25	12·7	....	3·8	....	2·5	....	....
19	1·42	23·6	....	36	....	14	0·87	3·3	....	2·4	....	....
20	....	26·0	....	36	....	15	....	3·1	0·77	2·3	....	....
21	....	29·0	1·57	36·3	1·32	16·6	....	2·9	....	2·3	....	....
22	....	32·0	....	36	....	19	....	2·7	....	2·3	....	....
23	1·56	35·4	....	36	....	22	0·8	2·5	0·77	2·3	....	....
24	....	33·0	1·56	35·4	....	25	....	2·5	....	2·2	....	....
25	....	31·0	....	36	1·47	27·6	....	2·5	....	2·1	....	....
26	1·48	28·4	....	37	....	32	0·8	2·5	....	2·0	....	....
27	....	28·0	....	38	....	36	....	2·5	0·72	1·9	....	....
28	....	27·0	1·6	39·0	1·62	41·0	....	2·4	....	1·8	....	....
29	....	27·0	....	35	....	30	....	2·4	....	1·7	....	....
30	1·46	26·8	....	30	....	18	0·77	2·3	0·67	1·6	....	....
31	....	....	1·45	26·0	....	....	....	2·4	....	1·6	....	....

Monte Creek (below Summit Lake Diversion.)

Location.—Section 22, township 18, range 14, west 6th meridian.

Records available.—May 25 to September 30, 1911; April 1 to September 17, 1912; June 20 to September 30, 1913.

Winter conditions.—Stream is usually frozen during winter months and, as a rule, there is no run-off during December, January, and February.

Gauge.—Vertical staff gauge with daily readings taken by Cecil Russell.

Channel.—Width of channel varies from 3 to 15 feet, the stream bed being gravelly. The flow varies from zero to 100 second-feet.

Discharge Measurements.—The gauge-height discharge curve is well defined by twelve meterings, most of which however were made at low medium stages.

Accuracy.—The accuracy of returns is high, but another meter measurement should be secured at a high stage during 1914.

DISCHARGE MEASUREMENTS of Monte Creek below Diversion Summit Lake.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1911			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
June 15	W. M. Carlyle	1,044	13·2	9·6	0·5	4·07	4·7
July 10	do	1,044	14·0	12·7	0·7	4·20	9·1
July 24	do	1,044	13·0	7·4	0·3	4·00	2·4
Aug. 18	do	1,044	3·5	1·3	0·5	3·83	0·6
1912							
May 11	C. E. Richardson	1,048	15·0	24·7	3·0	4·70	73·3
July 15	do	1,048	13·0	9·1	0·5	3·98	4·9
July 17	do	1,048	12·0	7·8	0·4	3·93	2·9
Aug. 27	do	1,048	13·0	4·2	0·4	3·74	1·6
1913							
April 24	H. J. E. Keys	1,057	14·0	13·2	0·8	4·17	11·0
June 20	do	1,057	14·0	11·9	1·1	4·18	12·8
Sept. 19	do	1,057	6·0	2·4	0·8	3·80	1·9[1]

NOTE.—[1]Different section.

MONTHLY DISCHARGE of Monte Creek below Diversion Summit Lake for 1913.

Month.	Discharge in Second-Feet.			Run-Off.
	Maximum.	Minimum.	Mean.	Total in acre-feet.
July	12·4	2·0	3·5	220
August	4·7	2·0	3·5	214
September	4·7	2·0	2·4	145

Daily Gauge Heights and Discharge of Monte Creek below Summit Lake Diversion for 1913.

Day.	April.		May.		June.		July.		August.		September.	
	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.
1							4·2	12·4	3·8	2·0	3·8	2·0
2							4·15	10·0	3·8	2·0	3·8	2·0
3							4·1	7·7	3·8	2·0	3·88	2·9
4							4·0	4·7	3·8	2·0	3·95	3·9
5							4·0	4·7	4·0	4·7	4·0	4·7
6							3·9	3·1	4·0	4·7	3·98	4·4
7							3·9	3·1	4·0	4·7	3·9	3·1
8							3·9	3·1	4·0	4·7	3·9	3·1
9							3·9	3·1	4·0	4·7	3·9	3·1
10							3·9	3·1	4·0	4·7	3·9	3·1
11							3·9	3·1	4·0	4·7	3·87	2·8
12							3·9	3·1	4·0	4·7	3·8	2·0
13							3·9	3·1	4·0	4·7	3·8	2·0
14							3·9	3·1	4·0	4·7	3·8	2·0
15							3·9	3·1	4·0	4·7	3·8	2·0
16							3·9	3·1	4·0	4·7	3·8	2·0
17							3·9	3·1	3·9	3·1	3·8	2·0
18							3·9	3·1	4·0	4·7	3·8	2·0
19							3·9	3·1	4·0	4·7	3·8	2·0
20					4·18	12·8	3·9	3·1	3·92	3·4	3·8	2·0
21							3·85	2·5	3·9	3·1	3·8	2·0
22					4·4	30·0	3·85	2·5	3·9	3·1	3·8	2·0
23					4·4	30·0	3·8	2·0	3·9	3·1	3·8	2·0
24					4·3	20·0	3·8	2·0	3·9	3·1	3·8	2·0
25	4·17	11·0			4·4	30·0	3·8	2·0	3·9	2·1	3·8	2·0
26					4·3	20·0	3·8	2·0	3·85	2·5	3·8	2·0
27					4·2	12·4	3·8	2·0	3·8	2·0	3·8	2·0
28					4·2	12·4	3·8	2·0	3·8	2·0	3·8	2·0
29					4·2	12·4	3·8	2·0	3·8	2·0	3·8	2·0
30					4·2	12·4	3·8	2·0	3·8	2·0	3·8	2·0
31							3·8	2·0	3·8	2·0		

MONTE CREEK DIVERSION TO SUMMIT LAKE.

Location.—Section 15, township 18, range 14, west 6th meridian.

Records Available.—May 25 to October 2, 1911; June 20 to September, 30, 1913.

Gauge.—Vertical staff gauge read daily during the irrigation season by C. Russell.

Channel.—The channel is about 10 feet in width, having a gravelly bed. This diversion supplements the natural run-off of Summit lake (or Essell) creek.

Discharge Measurements.—The new gauge established in 1913 has not yet been well rated, being defined by only three meterings.

Accuracy.—The accuracy is fair for discharges up to 12 second-feet. The deductions made for greater flow will be ratified during 1914 if possible.

MONTE CREEK DIVERSION TO SUMMIT LAKE.

The diversion is about half a mile long and the water flows into the north end of Summit lake. The headgate on Monte creek is about 12 miles from the mouth, and 100 yards above the hydrographic station called Monte Creek at Grahams ranch.

The gauge was established at the headgate. The water is changed from one channel to the other by moving logs and rocks. So every time the water is changed the gauging section is changed. In 1911 no changes were made, but

owing to the continual changing in 1912 no daily discharges were obtained. A new station was established and rated in 1913, and daily readings were obtained from May 20 to September 30.

DISCHARGE MEASUREMENTS of Monte Creek Diversion to Summit Lake, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
1911							
May 25	W. M. Carlyle	1,044	4·7	10·2	3·2	1·15	32·7
June 15	do	1,044	13·6	6·0	1·5	0·58	8·8
July 10	do	1,044	13·5	4·6	1·1	0·39	5·0
July 24	do	1,044	6·0	2·4	0·4	0·1	0·9
Aug. 18	do	1,044	2·0	0·6	0·4	0·03	0·2
1912							
May 11	C. E. Richardson	1,048	9·0	7·0	1·6	0·6	10·8
July 15	do	1,048	4·0	1·6	1·2	0·34	1·9
July 17	do	1,048	5·0	1·5	1·2	0·32	1·7
Aug. 27	do	1,049	3·0	0·7	0·6	0·18	0·4

MONTHLY DISCHARGE of Monte Creek Diversion to Summit Lake, for 1913.

MONTH.	DISCHARGE IN SECOND-FEET.			RUN-OFF.
	Maximum.	Minimum.	Mean.	Total in acre-feet.
July	21·4	8·7	12·8	790
August	8·7	1·3	3·4	210
September	2·7	0·3	1·0	60

DAILY GAUGE HEIGHTS AND DISCHARGES of Monte Creek Diversion to Summit Lake for 1913.

Day.	April.		May.		June.		July.		August.		September.	
	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft
1	....	....	....	....	....	....	1·15	21·4	0·7	6·1	0·4	1·3
2	....	....	....	....	....	....	1·0	15·6	0·7	6·1	0·4	1·3
3	....	....	....	....	....	....	1·0	15·6	0·8	8·7	0·45	1·8
4	....	....	....	....	....	....	1·0	15·6	0·8	8·7	0·52	2·7
5	....	....	....	....	....	....	1·0	15·6	0·6	4·0	0·5	2·4
6	....	....	....	....	....	....	1·0	15·6	0·6	4·0	0·45	1·8
7	....	....	....	....	....	....	0·9	12·0	0·6	4·0	0·4	1·3
8	....	....	....	....	....	....	0·9	12·0	0·6	4·0	0·4	1·3
9	....	....	....	....	....	....	1·0	15·6	0·6	4·0	0·4	1·3
10	....	....	....	....	....	....	0·9	12·0	0·6	4·0	0·4	1·3
11	....	....	....	....	....	....	0·9	12·0	0·55	3·1	0·4	1·3
12	....	....	....	....	....	....	1·0	15·6	0·55	3·1	0·35	1·0
13	....	....	....	....	....	....	1·1	19·4	0·55	3·1	0·35	1·0
14	....	....	....	....	....	....	1·1	19·4	0·55	3·1	0·35	1·0
15	....	....	....	....	....	....	1·1	19·4	0·55	3·1	0·32	0·8
16	....	....	....	....	....	....	1·0	15·6	0·5	2·4	0·3	0·7
17	....	....	....	....	....	....	1·0	15·6	0·5	2·4	0·3	0·7
18	....	....	....	....	....	....	0·9	12·0	0·6	4·0	0·3	0·7
19	....	....	....	....	....	....	0·9	12·0	0·6	4·0	0·3	0·7
20	....	....	....	....	0·81	9·2	0·8	8·7	0·55	3·1	0·3	0·7
21	....	....	....	....	....	....	0·8	8·7	0·5	2·4	0·3	0·7
22	....	....	....	....	0·9	12·0	0·8	8·7	0·5	2·4	0·3	0·7
23	....	....	....	....	0·9	12·0	0·8	8·7	0·5	2·4	0·3	0·7
24	0·90	12·0	....	....	0·8	8·7	0·8	8·7	0·5	2·4	0·3	0·7
25	....	....	....	....	0·9	12·0	0·8	8·7	0·5	2·4	0·25	0·5
26	....	....	....	....	1·0	15·6	0·8	8·7	0·45	1·8	0·25	0·5
27	....	....	....	....	1·1	19·4	0·8	8·7	0·45	1·8	0·2	0·3
28	....	....	....	....	1·2	23·4	0·8	8·7	0·4	1·3	0·2	0·3
29	....	....	....	....	1·2	23·4	0·8	8·7	0·4	1·3	0·2	0·3
30	....	....	....	....	1·2	23·4	0·8	8·7	0·4	1·3	0·2	0·3
31	....	....	....	....	....	....	0·8	8·7	0·4	1·3	....	....

NAHATLATCH RIVER (LOWER).

Location.—Section 7, township 2, range 26, west 6th meridian.

Records Available.—February 27, 1912, to December 31, 1913; January 1, 1913, to December 31, 1913.

Winter Conditions.—Open conditions exist throughout the winter.

Gauge.—Standard vertical staff gauge read weekly by C. Nicholson.

Channel.—There are rapids above and below the gauging section, where the current is slow and the water deep. The bed of the stream contains large boulders.

Discharge Measurements.—The gauge-height-discharge curve is well defined up to a discharge of 4,600 second-feet. Above this point it was necessary to project the curve during the freshet of 1913. An attempt will be made to have the deductions ratified during the coming season.

Accuracy.—The accuracy is high except for the period mentioned.

NAHATLATCH RIVER.

Nahatlatch river rises in the mountains north of Harrison lake outside the Railway belt, at an elevation of about 600 feet, and discharges into Fraser river at an elevation of 360 feet. It is part of the Fraser drainage. Douglas creek flows into the Nahatlatch from the south, and Log creek from the north. These two streams are close together, and only a short distance below the lakes.

The drainage area of the Nahatlatch at the upper measuring section, which is above the two tributaries, is 300 square miles; and the area above the mouth of the stream is 400 square miles. One very small tributary creek is used for irrigation, but the water of the main stream is not used in any way at present. The stream, however, has a good site for the development of water-power.

The upper part of the watershed of the Nahatlatch is rough and mountainous, with some peaks on which the snow remains until the fall. The country is timbered and some of the timber is very good. Near the lakes the valley is quite wide and for several miles above the lake the river flows quite slowly and sometimes overflows its banks and floods the hay meadows at the head of the lakes. The lakes themselves are at an elevation of 900 feet. There are four lakes in all, three of them being at practically the same elevation while the last is from 15 to 20 feet below. The three upper lakes are together seven miles long, while the lower is about half a mile, with half a mile of rapids between. The width varies from one quarter of a mile to a mile. The hills rise quite steeply from the water's edge except at the mouth of two or three creeks where there are deltas. Snow slides are quite frequent, and it is very hard to keep a trail open along the lakes. The lake is quite deep in most parts. There is good fishing in the lakes and in the rivers.

Below the lakes the river is a series of rapids, falling 550 feet in 8 miles. It is for this reason that no attempt has been made to run logs in the river. But with this fall it would be quite possible to develop a large amount of power. The lakes would provide the necessary storage. The great drawback to the scheme is the necessity for about seven miles of flume and pipeline necessitating a large expense for construction and considerable attention during operation to prevent damage from slides and falling timber. Probably as much as 30,000 horse power could be developed if desired.

There is some land being cultivated near the mouth of the Nahatlatch river. Fruit seems to do fairly well there. There is one home-steader about 4 miles up the valley, and there is no one beyond him. A few years ago, part of the hay meadow at the head of the lakes was taken up as a homestead. But a big log jam in the river caused the flooding of the meadows, and the house was washed away. Since that time no attempt has been made to cultivate that land. The use of the lakes for storage for power purposes will mean that this land will be flooded, and it is merely a matter of deciding which will be of greater value.

Gauging stations were established at two places on the Nahatlatch. One is at the outlet of the lakes and gives the flow from them. The other is two miles below the lakes and gives the total flow of the stream including the two tributaries, Douglas creek and Log creek which enter about half a mile below the lakes. The river is very rapid and the bed thickly strewn with large boulders, but by carefully choosing the section, blasting out some of the worst boulders and putting up cables and cars, two fairly good metering stations were obtained. Part of this work was done by engineers of the Canadian Pacific Railway Company who were investigating the power possibilities of the stream. Gauges were established and are being read by Chas. Nicholson, a prospector, who is the only person living in the Nahatlatch valley. He is 4 miles from the farthest gauge and makes the trip once a week. The stations were established on February 26, 1912, and weekly gauge readings have been taken at both stations continuously since that date.

The upper station is 8 miles west of Keefers station, and 200 yards east of the lowest of the Nahatlatch lakes. There is a chain gauge of No. 12 steel Jack chain with a 6 pound sash weight. The chain runs over a pulley on the end of a log, supported against two trees, and overhanging the stream. It is referred to three permanent bench-marks. For the meter measurements there is a half-inch steel cable stretched across the stream and supported by trees

on each bank. A substantial car is suspended from the cable by means of two heavy snatch blocks. The engineer can thus place himself directly over any part of the section and take measurements with a meter suspended by its cable. The channel above the station is straight for 100 feet with the water flowing smoothly. About 400 feet above the section there are rapids when the water leaves the lake. Below the section the channel is straight for 100 feet and then the rapids commence again. The right bank is 100 feet high with a steep slope. The left bank is 50 feet high, with a fairly steep slope, and with bushes and trees above the high-water mark. The bed of the stream is covered with rocks and boulders and these make it rather difficult to get accurate measurements. There is only one channel, about 4 feet deep at low water.

DISCHARGE MEASUREMENTS of Nahatlatch River near Lower Station, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
June 26	Chisholm & Cline	1,044	95	747	6·47	6·4	4,640
July 4	K. G. Chisholm	1,055	93	627	5·09	4·95	3,196
Sept. 21	do	1,055	80	431	2·96	2·63	1,273
1912							
July 23	C. G. Cline					3·75	1,920
Nov. 28	do					2·20	891

MONTHLY DISCHARGE of Nahatlatch River near Lower Station for 1913.

(Drainage area, 400 square miles.)

MONTH.	DISCHARGE IN SECOND-FEET.				RUN-OFF.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
January	370	281	328	0·82	0·95	20,168
February	410	230	298	0·74	0·77	16,550
March	295	240	275	0·69	0·79	16,900
April	1,680	271	914	2·28	2·54	54,387
May	6,148	730	3,149	7·87	9·07	193,700
June	6,350	4,100	5,074	12·68	14·15	302,000
July	4,520	3,022	3,661	9·15	10·55	225,000
August	3,086	1,525	2,083	5·21	6·01	127,900
September	2,880	830	1,732	4·33	4·83	103,000
October	2,927	841	1,466	3·66	4·22	90,000
November	1,140	685	887	2·22	2·48	52,780
December	855	450	578	1·44	1·66	35,540
Year	6,350	230	1,704	51·09	58·02	1,237,934

Daily Gauge Heights and Discharges of Nahatlatch River, near Lower Station for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	...	370	...	273	...	247	...	271	...	937	8·00	6,350
2	...	370	·65	265	·55	240	...	273	...	868	...	6,310
3	...	370	...	260	...	246	...	275	...	799	...	6,270
4	1·0	370	...	255	...	252	...	277	1·90	730	...	6,231
5	...	365	...	250	...	258	...	279	...	1,092	...	6,192
6	...	360	...	245	...	264	·70	280	...	1,454	...	6,153
7	...	355	...	240	...	269	...	344	...	1,816	...	6,114
8	...	349	...	235	...	274	...	408	...	2,178	7·75	6,075
9	...	343	·50	230	·70	280	...	472	...	2,540	...	5,852
10	...	337	...	256	...	282	...	536	...	2,902	...	5,630
11	...	331	...	282	...	284	...	600	5·10	3,265	...	5,408
12	·85	325	...	308	...	286	...	665	...	3,118	...	5,186
13	...	322	...	334	...	288	1·90	730	...	2,970	...	4,964
14	...	320	...	359	...	290	...	865	...	2,822	...	4,742
15	...	318	...	384	...	292	...	1,000	...	2,674	6·30	4,520
16	...	316	1·10	410	·75	295	...	1,136	...	2,526	...	4,460
17	...	314	...	394	...	293	...	1,272	...	2,378	...	4,400
18	...	312	...	378	...	291	...	1,408	4·00	2,230	...	4,340
19	·80	310	...	368	...	289	...	1,544	...	2,617	...	4,280
20	...	312	...	346	...	287	3·35	1,680	...	3,004	...	4,220
21	...	314	...	329	...	285	...	1,613	...	3,391	...	4,160
22	...	316	...	312	...	282	...	1,546	...	3,778	5·9	4,100
23	...	318	·75	295	·70	280	...	1,479	...	4,165	...	4,178
24	...	320	...	287	...	277	...	1,412	...	4,552	...	4,257
25	...	322	...	279	...	274	...	1,346	6·70	4,940	...	4,336
26	·85	325	...	271	...	272	2·80	1,280	...	5,141	6·20	4,416
27	...	316	...	263	...	270	...	1,212	...	5,342	...	4,625
28	...	307	...	255	...	268	...	1,144	...	5,543	...	4,835
29	...	298	...	...	·65	265	...	1,075	...	5,744	6·80	5,045
30	...	289	...	...	...	267	...	1,006	...	5,946	...	4,669
31	...	281	...	...	...	269	...	...	...	6,148	...	...

Daily Gauge Heights and Discharges of Nahatlatch River, near Lower Station for 1913.—*Continued.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1		4,293		3,086		1,852		810		763		855
2		3,917	4·80	2,975		2,023		790	1·8	685		820
3		3,541		2,870		2,194		770		719		785
4	5·00	3,165		2,765		2,365		750		753		750
5		3,370		2,660		2,536	1·9	730		787		715
6	5·40	3,575		2,556		2,708		1,043		821		680
7		3,496		2,452	4·70	2,880		1,357		854	1·7	645
8		3,417		2,348		2,745		1,671		887		628
9		3,338		2,244		2,610		1,985	2·25	920		610
10		3,259	3·90	2,140		2,475		2,299		952		592
11		3,180		2,052		2,340		2,613		984		574
12		3,101		1,964		2,205	4·75	2,927		1,016		556
13	4·85	3,022		1,876		2,070		2,687		1,047		538
14		3,236		1,788		1,935		2,447		1,078	1·4	520
15		3,450		1,700	3·50	1,800		2,207		1,109		515
16		3,664		1,612		1,696		1,967	2·6	1,140		510
17		3,878	3·15	1,525		1,592		1,726		1,081		504
18		4,092		1,607		1,488		1,485		1,022		498
19		4,306		1,689		1,384	2·75	1,245		963		492
20	6·30	4,520		1,770		1,280		1,256		905		486
21		4,397		1,851	2·65	1,175		1,267		847	1·3	480
22		4,275		1,932		1,127		1,278		789		475
23		4,153		2,013		1,079		1,290	1·9	730		470
24		4,031	3·85	2,095		1,031		1,302		752		466
25		3,909		2,035		984	2·85	1,315		775		462
26		3,786		1,975		937		1,236		798		458
27		3,663		1,916	2·20	890		1,157		821		454
28		3,540		1,857		870		1,078		844	1·2	450
29	5·25	3,417		1,798		850		999		867		549
30		3,307		1,739		830		920	2·2	890		648
31		3,197	3·35	1,680				841				747

NAHATLATCH RIVER (UPPER STATION) NEAR KEEFERS.

Location.—Section 14, township 12, range 27, west 6th meridian.

Records Available.—February 26 to December 31, 1912; January 1 to December 31, 1913.

Winter Conditions.—Open conditions exist throughout the winter.

Gauge.—There is a chain gauge at which weekly records are taken by Chas. Nicholson.

Channel.—The channel is straight, with rapids a short distance above and below the gauge.

Discharge Measurements.—Meterings are made from a cable car, and the gauge-height-discharge curve is well defined up to a discharge of 3,600 feet. The curve has been projected above that point.

Accuracy.—The accuracy is fair except for the short period at the peak of the freshet. The deductions made for this period will, it is expected, be ratified during the coming season.

Discharge Measurements of Nahatlatch River, at Upper Station, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
June 26	C. G. Cline	1,044	120	764	5·0	8·1	3,659
Sept. 21	K. G. Chisholm	1,055	85	437	2·37	5·1	1,036
1912.							
Feb. 25	C. G. Cline	1,046	65	256	1·6	3·45	417
July 18	do	1,046	105	530	3·6	6·35	1,930
Nov. 28	do	1,048	80	381	2·1	4·35	817

Monthly Discharge of Nahatlatch River at Upper Station, for 1913.

(Drainage area, 300 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
January	447	377	401	1·34	1·54	24,650
February	535	345	420	1·40	1·46	23,300
March	395	360	372	1·24	1·43	22,870
April	1,465	360	869	2·89	3·22	51,700
May	4,953	730	2,552	8·51	9·81	156,900
June	5,120	3,450	4,222	14·07	15·70	251,200
July	4,220	2,710	3,361	11·20	12·91	206,600
August	2,695	1,280	1,835	6·12	7·06	112,830
September	2,610	828	1,560	5·20	5·80	92,830
October	2,510	809	1,318	4·39	5·06	81,160
November	1,160	710	860	2·87	3·20	51,173
December	921	535	649	2·16	2·49	39,905
Year	5,120	345	1,535	5·12	69·68	1,115,118

Daily Gauge Heights and Discharges of Nahatlatch River at Upper Station for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	412	....	387	....	370	....	360	....	895	9·4	5,120
2	....	412	3·35	377	3·30	360	....	360	....	840	....	5,103
3	....	412	....	372	....	363	....	360	....	785	....	5,086
4	3·45	412	....	367	....	366	....	360	4·3	730	....	5,069
5	....	407	....	362	....	369	....	360	....	1,020	....	5,052
6	....	402	....	357	....	371	3·3	360	....	1,310	....	5,035
7	....	397	....	353	....	373	....	413	....	1,600	....	5,017
8	....	393	....	349	....	375	....	466	....	1,890	....	5,000
9	....	389	3·25	345	3·35	377	....	519	....	2,180	9·3	4,818
10	....	385	....	373	....	380	....	572	....	2,470	....	4,636
11	....	381	....	400	....	383	....	625	7·25	2,760	....	4,454
12	3·55	377	....	427	....	386	....	678	....	2,598	....	4,272
13	....	377	....	454	....	389	4·3	730	....	2,436	....	4,090
14	....	377	....	481	....	391	....	835	....	2,274	....	3,908
15	....	377	....	508	....	393	....	940	....	2,112	8·15	3,725
16	....	377	3·8	535	3·40	395	....	1,045	....	1,950	....	3,685
17	....	377	....	520	....	390	....	1,145	....	1,788	....	3,645
18	....	377	....	505	....	385	....	1,255	5·95	1,627	....	3,606
19	3·35	377	....	490	....	380	....	1,360	....	1,958	....	3,567
20	....	387	....	475	....	375	5·7	1,465	....	2,289	....	3,528
21	....	397	....	460	....	370	....	1,415	....	2,620	....	3,489
22	....	407	....	445	....	365	....	1,365	....	2,951	7·9	3,450
23	....	417	3·50	430	3·30	360	....	1,315	....	3,282	....	3,560
24	....	427	....	420	....	360	....	1,265	....	3,613	....	3,670
25	....	437	....	410	....	360	....	1,215	8·35	3,945	....	3,780
26	3·55	447	....	400	....	360	....	1,165	....	4,113	8·3	3,890
27	....	437	....	390	....	360	5·1	1,115	....	4,281	....	4,000
28	....	427	....	380	....	360	....	1,060	....	4,449	....	4,110
29	....	417	....	....	3·30	360	....	1,005	....	4,617	8·6	4,220
30	....	407	....	....	....	360	....	950	....	4,735	....	4,000
31	....	397	....	....	....	360	....	....	....	4,953	....	....

DAILY GAUGE HEIGHTS AND DISCHARGES of Nahatlatch River at Upper Station for 1913—*Continued.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1		3,952		2,695		1,685		809		767		921
2		3,818	7·1	2,610		1,840		795	4·5	710		882
3		3,685		2,518		1,994		781		713		843
4		3,552		2,426		2,148		767		716		804
5		3,419		2,335		2,302	4·35	752		719		766
6	7·75	3,285		2,244		2,456		1,003		722		728
7		3,202		2,153	7·1	2,610		1,254		725	4·2	690
8		3,120		2,062		2,465		1,505		728		679
9		3,038		1,971		2,320		1,756	4·3	730		667
10		2,956	6·3	1,880		2,175		2,007		792		655
11		2,876		1,794		2,030		2,258		854		644
12		2,792		1,708		1,885	7·0	2,510		916		632
13	7·2	2,710		1,622		1,740		2,310		977		621
14		2,926		1,536	5·9	1,595		2,110		1,038	4·0	610
15		3,142		1,455		1,526		1,911		1,099		604
11		3,358		1,370		1,457		1,712	5·0	1,160		598
17		3,574	5·4	1,280		1,388		1,513		1,099		592
18		3,789		1,366		1,320		1,314		1,038		580
19		4,005		1,452		1,252	5·1	1,115		977		580
20	8·6	4,220		1,538		1,184		1,125		916		575
21		4,063		1,624	5·1	1,115		1,134		854	3·9	570
22		3,906		1,710		1,073		1,143		792		565
23		3,749		1,795		1,031		1,152	4·3	730		566
24		3,592	6·3	1,880		1,989		1,161		762		555
25		3,435		1,830		947	5·2	1,170		795		550
26		3,278		1,780		906		1,112		828		545
27	7·6	3,120		1,730	4·6	865		1,054		861		540
28		3,035		1,680		851		996		894	3·8	535
29		2,950		1,630		837		938		927		603
30		2,865		1,680		823		881	4·8	960		671
31		2,780		1,530				824				739

Nicola River at Merritt.

Locations.—The station is located just below the town of Merritt on the Nicola Valley branch of the C. P. R., below the confluence of the Coldwater and Nicola rivers.

Data Available.—June 16, 1911, to December 31, 1911; January 31, 1912, to December 31, 1912; January 1, 1913, to December 31, 1913.

Winter Conditions.—Practically open-flow throughout the entire season.

Gauge.—Vertical staff gauge read tri-weekly by Miss Seaton.

Channel.—The bed of the stream is gravelly and the flow is in two channels during high stages.

Discharge Measurements.—Ten well-distributed measurements have been obtained and the stream is well rated.

Accuracy.—The accuracy is high and is considered to be within 10 per cent of actual conditions obtaining.

NICOLA RIVER AT MERRITT.

The Nicola river has its source in Nicola lake at an elevation of 2,020 feet and discharges into the Thompson at Spences Bridge at an elecation of 700 feet.

The chief tributaries are: from the left, going upstream, Skuhun creek, Guichon creek, Clapperton creek; from the right, going upstream, Agate creek,

Spius creek and Coldwater river. The drainage area above the mouth, from the Geological Survey map, scale 3 miles to 1 inch, is 2,650 square miles above the mouth and 1,500 miles above the confluence of the Coldwater.

The station at Merritt, which is just below the confluence of the Clearwater, was established in June, 1911, and continuous gauge readings have been taken since June 19, 1911, by C. A. Seaton.

Discharge Measurements of Nicola River at Merritt, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
May 14........	H. J. E. Keys.................	1057	53	292	4·7	6·45	1,366

Note.—Gauge reader—Miss Seaton.

Monthly Discharge of Nicola River at Merritt for 1913.

(Drainage area, 1,500 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
January..............................	46	29	33	0·02	·02	2,029
February..............................	157	29	87	0·06	0·06	4,832
March..............................	125	46	84	0·06	0·07	5,165
April..............................	543	46	256	0·17	0·19	15,233
May..............................	2,915	353	1,318	0·88	1·01	81,040
June..............................	4,115	974	1,755	1·17	1·30	104,430
July..............................	932	174	504	0·34	0·39	30,990
August..............................	288	57	147	0·10	0·11	9,039
September..............................	228	42	109	0·07	0·08	6,486
October..............................	443	22	151	0·10	0·11	9,285
November..............................	157	67	97	0·06	0·07	5,772
December..............................	95	5	36	0·02	0·02	2,214
The year..............................	4,115	5	381	0·25	3·43	276,515

DAILY GAUGE HEIGHTS AND DISCHARGES of Nicola River at Merritt for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	46	4·55	37	4·9	125	....	46	....	375	....	3,215
2	4·6	46	....	37	....	118	4·6	46	5·5	353	8·2	3,515
3	....	42	4·55	37	4·85	110	....	46	....	353	8·5	4,115
4	4·55	37	....	33	....	110	4·6	46	5·5	353	....	3,515
5	....	33	4·5	29	4·85	110	....	46	....	353	7·9	2,915
6	4·5	29	....	29	....	103	4·6	46	5·5	353	....	2,437
7	....	29	4·5	29	4·8	95	....	46	....	423	7·4	1,960
8	4·5	29	....	29	....	95	4·6	46	5·8	494	....	1,960
9	....	29	4·5	29	4·8	95	....	46	6·3	782	7·4	1,960
10	4·5	29	....	33	....	95	4·6	46	6·7	1,102	....	1,887
11	....	29	4·55	37	4·8	95	....	78	....	1,058	7·3	1,805
12	4·5	29	....	46	....	95	4·85	110	6·6	1,015	....	1,730
13	....	29	4·65	56	4·8	95	....	150	....	973	7·2	1,655
14	4·5	29	....	98	....	95	5·1	190	6·5	932	....	1,425
15	....	29	4·95	141	4·8	95	....	209	....	893	6·8	1,195
16	4·5	29	....	149	....	76	5·2	228	6·4	855	....	1,105
17	....	29	5·0	157	4·7	67	....	269	....	893	6·6	1,015
18	4·5	29	....	149	....	74	5·4	310	6·5	932	....	1,210
19	....	29	4·95	141	4·75	81	....	426	....	974	7·0	1,405
20	4·5	29	....	133	....	74	5·9	543	6·6	1,015	....	1,405
21	....	29	4·9	125	4·7	67	....	519	....	1,213	7·0	1,405
22	4·5	29	....	125	....	67	5·8	494	7·0	1,405	....	1,300
23	....	29	4·9	125	4·7	67	....	494	7·25	1,730	6·8	1,195
24	4·5	29	....	125	....	67	5·8	494	7·6	2,320	....	1,148
25	....	33	4·9	125	4·7	67	....	494	7·8	2,715	6·7	1,102
26	4·55	37	....	125	....	67	5·8	494	....	2,815	....	1,060
27	....	37	4·9	125	4·7	67	....	469	7·9	2,915	6·6	1,015
28	4·55	37	....	125	....	67	5·7	443	....	2,815	....	1,015
29	....	37	....	....	4·7	67	....	420	7·8	2,715	6·6	1,015
30	4·55	37	....	....	....	57	5·6	397	....	2,815	....	974
31	....	37	....	....	4·6	46	....	....	7·9	2,915	....	....

DAILY GAUGE HEIGHTS AND DISCHARGES of Nicola River at Merritt for 1913.—*Continued*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	6·5	932	....	277	4·6	46	4·55	37	....	95	....	95
2	....	894	5·35	288	....	71	....	33	4·8	95	4·8	95
3	6·4	855	....	258	4·8	95	4·5	29	....	95	....	81
4	....	819	5·2	228	....	126	....	25	4·8	95	4·7	67
5	6·3	782	....	209	5·0	157	4·45	22	....	88	....	56
6	....	750	5·1	190	....	192	....	22	4·75	81	4·6	46
7	6·2	715	....	174	5·2	228	4·45	22	....	74	....	70
8	....	683	5·0	157	....	209	....	90	4·7	67	4·8	95
9	6·1	652	....	157	5·1	190	5·0	157	....	67	....	55
10	....	637	5·0	157	....	174	....	300	4·7	67	4·4	15
11	6·05	623	....	157	5·0	157	5·7	443	....	67	....	10
12	....	596	5·0	157	....	141	....	398	4·7	67	4·2	5
13	5·95	569	....	157	4·9	125	5·5	353	....	67	....	17
14	....	544	5·0	157	....	125	....	290	4·7	67	4·5	29
15	5·85	519	....	141	4·9	125	5·2	228	....	81	....	37
16	....	494	4·9	125	....	110	....	192	4·8	95	4·6	46
17	5·75	468	....	141	4·8	95	5·0	157	....	126	....	37
18	....	444	5·0	157	....	95	....	141	5·0	157	4·5	29
19	5·65	420	....	157	4·8	95	4·9	125	....	141	....	22
20	....	386	5·0	157	....	88	....	141	4·9	125	4·4	15
21	5·5	353	....	141	4·75	81	5·0	157	....	110	....	10
22	....	331	4·9	125	....	74	....	157	4·8	95	4·3	5
23	5·4	310	....	110	4·7	67	5·0	157	....	95	....	5
24	....	293	4·8	95	....	67	....	149	4·8	95	4·3	5
25	5·3	267	....	88	4·7	67	4·95	141	....	110	....	10
26	....	220	4·75	81	....	67	....	133	4·9	125	4·4	15
27	5·05	174	....	74	4·7	67	4·9	125	....	125	....	22
28	....	191	4·7	67	....	57	....	125	4·9	125	4·5	29
29	5·15	209	....	67	4·6	46	4·9	125	....	110	....	29
30	....	238	4·7	67	....	42	....	110	4·8	95	4·5	29
31	5·3	267	....	57	....	....	....	95	....	....	....	29

NICOLA RIVER (MOUTH).

Location.—Section 1, township 17, range 25, west 6th meridian.

Records Available.—August 1 to December 1, 1911; April 5 to December 21, 1912; May 9 to December, 11, 1913.

Winter Conditions.—Not very severe. Stream is usually under ice cover during January and February.

Gauge.—Inclined staff gauge bolted to a large rock on the stream's right bank, and referred to bench-marks. Tri-weekly readings are obtained by Miss Violet Curnow.

Channel.—Stream is 100 to 150 feet in width, and has a rock and gravel bed. Flow varies from 150 to 5,000 c.f.s., and in gauge heights is 6 feet.

Discharge Measurements.—The gauge-height-discharge curve is defined by well-distributed measurements.

Accuracy.—The curve is excellently defined up to a discharge of 4,000 second-feet, which represents the maximum flow for an average year. Above this point the curve is projected for the season of 1913 when a maximum of 5,300 second-feet, was recorded. The accuracy of the whole is very high.

NICOLA RIVER AT MOUTH.

The Nicola river rises in Nicola lake at an elevation of 2,020 feet, and discharges into the Thompson river near Spences Bridge, at an elevation of 700 feet.

The mean annual precipitation over the whole drainage area is very small, not exceeding 15 inches. The area of the watershed is 2,650 square miles, 1,500 square miles of which is about 45 miles long and rises in Nicola lake, at an elevation of 2,020 feet. Nicola lake is 10 miles long and from half a mile to 1½ miles wide. It is fed chiefly by the following streams:

(1) Guichon creek, which rises in the hills 15 miles south of Nicola lake, at an elevation of 3,000 feet.

(2) The upper Nicola river rises in the Trepanage plateau some 25 miles southeast of Nicola lake at an elevation of 4,000 feet. Chaperon and Douglas lakes are both tributaries of this stream.

(3) Stump lake and its tributaries 10 miles north-east of Nicola lake.

(4) Moore Creek, which rises in the hills 10 miles north of Nicola lake.

From Nicola lake the Nicola river flows in a southerly and westerly direction for 7 miles to Merritt, where it is joined by the Coldwater river. The Coldwater river is a large and flashy stream, draining 360 miles of country south of Merritt, and rising on the east slope of Anderson river mountain at an elevation of 4,000 feet. From Merritt the Nicola river flows in a northwesterly direction for 40 miles to discharge into the Thompson river at Spences Bridge, at an elevation of 650 feet. Thirty-five miles from the mouth, at Lower Nicola, Guichon creek enters. Guichon creek is a very contentious irrigation stream, and drains 475 square miles of land, a large percentage of which is suitable for cultivation, (See Gazetteer on Guichon creek.) Twenty-nine miles from the mouth, at Canford, Spius creek flows into the Nicola river. Spius creek drains 160 square miles of land east of Canford, rising 10 miles northwest of the source of the Coldwater river, at an elevation of 3,500 feet.

The Nicola Valley is a famous ranching country, the rolling hills being suitable for grazing lands. Possibly the most celebrated district in the valley is the Douglas lake country. Here some 100,000 acres of land is controlled by one large company, known as the Douglas Lake Cattle Company.

Good agricultural districts are scattered all through the Nicola river drainage. On Guichon creek alone probably 20,000 acres of land are under cultivation. The land around Nicola lake is all taken up. All through the valley, however, in dry seasons there is a scarcity of water, not so much due to the lack of water but to the lack of system in properly ulitizing the water, and good ditches.

Considerable mining is carried on in the Nicola valley. At Merritt three coal mines are in operation, and in the vicinity several rich gypsum claims have been recorded.

Practically all water-power possibilities of Nicola river proper have been eliminated by the presence of the C.P.R. Nicola Valley branch. This railroad follows the river between Spences Bridge and Merritt, and any development would interfere with the present right of way. There is small industrial power on Spius creek, but any installation would be expensive. The Coldwater river affords similar opportunities to Spius creek, but the power all through the valley is very limited.

There are two stations on Nicola river. The upper one at Merritt was established on June 17, 1911, by C. E. Richardson, and readings have been taken during 1911, 1912, and 1913.

The measuring section is located on the upstream side of the highway bridge, immediately below the mouth of the Coldwater river. Merritt station is slightly over 1 mile distant from the C.P.R. track. Measurements are made by cable suspension.

The gauge is a 6-foot standard vertical staff gauge. It is nailed to the right abutment of the bridge on its upstream side.

The stream is confined between the bridge abutment to one channel, whose bed is gravelly.

The elevation of the south rail of the C, P. R. Spences Bridge to Nicola Branch at the crossing of the road to Collettsville is 15·03 feet above the datum of the gauge.

The station at the mouth of Nicola river was established on June 19, 1911, by C. E. Richardson. The measuring section is located 200 yards from the mouth of the river on the upstream side of the highway bridge. Measurements are made by cable suspension. The gauge is an inclined staff bolted to a large rock on the right bank of the stream about six hundred yards above the measuring section.

The river is always confined to one channel, whose bed is rock and gravel with no vegetation. During high stages of the Thompson river water is backed up to the measuring section, but not to the gauge.

Discharge Measurements of Nicola River at Mouth, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
May 9	K. G. Chisholm	1044	130	490	5·44	5·49	2,586
June 7	do	1055	150	778	5·34	6·65	4,159
August 12	do	1055	113	194	2·11	2·5	410

Monthly Discharge of Nicola River at Mouth for 1913.

(Drainage area, 2,650 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May	5,375	2,380	3,484	1·31	1·52	214,220
June	5,375	2,576	3,619	1·36	1·52	215,340
July	2,423	730	1,302	0·49	0·57	80,050
August	700	180	402	0·15	0·17	24,718
September	1,965	180	603	0·23	0·25	35,881
October	725	180	444	0·17	0·19	27,300
November	544	356	439	0·17	0·18	26,122
December			220	0·08	0·09	13,527
The period	5,375	180	1,314	0·49	4·49	637,158

DAILY GAUGE HEIGHTS AND DISCHARGES of Nicola River at Mouth for 1913.

Day.	May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	....	7·4	5,375
2	....	....	....	5,251
3	....	....	....	5,144
4	....	....	....	5,037
5	....	....	7·2	4,925
6	....	....	....	4,486
7	....	....	6·6	4,050
8	....	....	....	4,050
9	5·3	2,380	....	4,050
10	....	2,416	6·6	4,050
11	....	2,452	....	3,750
12	5·4	2,490	....	3,450
13	....	2,520	....	3,150
14	....	2,550	5·7	2,850
15	....	2,580	....	2,850
16	5·5	2,610	....	2,850
17	....	2,650	5·7	2,850
18	....	2,690	....	3,242
19	5·6	2,730	6·3	3,635
20	....	2,706	....	3,590
21	....	2,682	....	3,545
22	....	2,660	6·2	3,500
23	6·3	3,635	....	3,282
24	....	4,070	....	3,066
25	....	4,505	5·7	2,850
26	....	4,940	....	2,820
27	7·5	5·375	....	2,790
28	....	5,375	....	2,760
29	....	5,375	5·6	2,730
30	....	5,375	....	2,576
31	....	5,375	....	....

DAILY GAUGE HEIGHTS AND DISCHARGES of Nicola River at mouth for 1913.—*Continued.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	2,423	....	700	....	180	....	216	....	544	....	337
2	5·2	2,270	....	671	1·8	180	1·9	210	....	525	2·2	300
3	....	2,147	....	642	....	890	....	195	....	506	....	276
4	....	2,023	....	613	4·5	1,600	1,8	180	....	487	....	253
5	....	1,899	....	584	4·9	1,965	....	180	....	468	....	232
6	4·7	1,775	....	555	....	1,650	....	180	....	449	1·9	210
7	....	1,665	....	526	....	1,335	1·8	180	....	430	....	187
8	....	1,555	....	497	3·7	1,020	....	200	....	411	....	174
9	4·3	1,445	....	468	....	905	....	220	....	392	....	161
10	....	1,407	....	439	....	790	2·0	240	....	373	....	158
11	....	1,369	2·5	410	3·1	675	....	280	....	354	1·65	145
12	....	1,332	....	382	....	602	....	320	2·3	335	....	....
13	4·1	1,295	....	354	2·8	530	....	360	....	415	....	....
14	....	1,258	....	327	2·9	575	....	400	....	495	....	....
15	....	1,222	2·2	300	....	506	....	440	2·9	575	....	....
16	....	1,186	....	323	....	438	....	480	....	553	....	....
17	3·9	1,150	....	346	2·4	370	....	521	....	531	....	....
18	....	1,120	2·4	370	....	359	....	562	....	509	....	....
19	....	1,090	....	430	....	347	....	603	....	487	....	....
20	....	1,060	2·7	490	2·3	335	....	644	....	465	....	....
21	....	1,030	2·5	410	....	335	....	685	....	443	....	....
22	....	1,000	....	355	....	335	3·2	725	....	421	....	....
23	....	970	2·2	300	....	335	....	715	....	399	....	....
24	....	940	....	300	2·3	335	....	696	....	377	....	....
25	....	910	....	300	....	304	....	677	....	356	....	....
26	....	880	2·2	300	....	272	....	658	2·3	335	....	....
27	....	850	....	270	2·0	240	....	639	....	360	....	....
28	....	820	....	240	....	234	....	620	....	385	....	....
30	....	790	....	210	....	228	....	601	2·5	410	....	....
30	....	760	1·8	180	....	222	....	582	....	374	....	....
31	....	730	....	180	....	....	....	563	....	....	....	....

NISKONLITH CREEK NEAR SHUSWAP.

Location.—Section 5, township 21, range 13, west 6th meridian, below Niskonlith lake.

Records Available.—September 1 to December 1, 1911; April 1 to September 13, 1912; May 1 to September 30, 1913.

Winter Conditions.—Some short cold spells during the winter. Stream is practically dry from November to March.

Gauge.—Vertical staff gauge read semi-weekly by Miss Violet Hoffman.

Channel.—The stream bed is composed of large rocks and boulders, the current is swift and the control good.

Discharge Measurements.—The curve is poorly defined for medium stages although meterings have been secured at high and low water.

Accuracy.—The accuracy on the whole cannot be vouched for until further meterings are obtained.

NISKONLITH CREEK.

Niskonlith creek, is a stream about 10 miles in length, 4 to 10 feet in width and varies from a few inches to 2 feet in depth. Its drainage area is 50 square miles. Its source is in the hills of township 22, range 14, west of the 6th meridian, the northern slope of which feeds McGillivary creek an important tributary of Louis creek. Niskonlith creek is little known and as yet unused above Niskon-

lith lake, an ideal storage reservoir 2 miles from South Thompson river at an elevation of 1,620 feet. The Indians of the Niskonlith reserve are the principal users, and the flow is well regulated by a dam installed by the Indian Department. It is capable of raising the level of Niskonlith lake, whose area is 1,000 acres, 8 feet, thus impounding 8,000 acre-feet which is however, much in excess of the normal run-off of the stream. The normal precipitation in the Niskonlith watershed is about 15 to 20 inches per annum.

There is sufficient water in Niskonlith creek for all users, and suggestion has been made that some of it might be applied to land in the Pemberton and Moulton Creek valleys.

A drop of over 500 feet in 2 miles between Niskonlith lake and the South Thompson indicated the possibility of a small power development. The mean flow, however is very small, but it might be augmented by diversion from a tributary of Adams lake.

The station was established on August 26, 1911, by C. G. Cline, and semi-weekly gauge readings taken during the remainder of the 1911 and the whole of the 1912 and 1913 irrigation season. The station is located about half a mile above the highway, along the South Thompson river, and half mile below Niskonlith lake. It is also half a mile below the intake for the Indian Reserve irrigation ditch.

The gauge is a 3 foot standard gauge, nailed to an inch birch on the right bank of the stream. It is nearly opposite an old deserted cabin, which stands on the flat. Measurements are made by wading. The banks are 3 to 5 feet in height, and the stream is confined to one channel, which varies in depth from a few inches to 2 feet. There are bench-marks, whose elevations are referred to the datum of the gauge.

DISCHARGE MEASUREMENTS of Niskonlith Creek near Shuswap for 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
1911.							
Aug. 28......	C. G. Cline..................	1,046	10	9·2	0·5	0·66	4·43
1912.							
April 17......	Cline & Dann................	1,046	10	0·15	0·6	0·88	0·1
May 20......	E. M. Dann..................	1,044	80	17·9	3·7	1·92	66·9

MONTHLY DISCHARGE of Niskonlith Creek, near Shuswap for 1913.

(Drainage area, 50 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May....................................	26·5	3·0	13·5	0·26	0·30	830
June....................................	38·0	26·5	33·4	0·66	0·74	1,990
July....................................	30·2	0·4	8·1	0·16	0·18	500
August..................................	17·5	0·4	11·9	0·24	0·28	730
September..............................	15·0	10·5	11·7	0·24	0·26	700

NOTE.—Artificial control.

DAILY GAUGE HEIGHTS AND DISCHARGES of Niskonlith Creek, near Shuswap, for 1913.

Day.	May.		June.		July.		August.		September.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1		3·0		26·5	1·3	29·0	0·4	0·4	1·0	15
2		3·0		26·5		29·3		0·4		14·6
3		3·0	1·25	26·5		29·6		0·4		14·2
4		3·0		30·0		29·9	0·4	0·4	0·95	13·7
5		3·0		34·0	1·32	30·2		0·4	0·95	13·2
6		5·3	1·45	38·0		30·2		0·4		12·8
7		5·3		38·0		30·2	0·4	0·4		12·5
8		5·3		38·0	0·45	0·9		0·4	0·92	12·2
9		5·3		38·0		2·3		0·4		12·0
10		5·3	1·45	38·0		3·8		0·4		11·8
11		8·1		37·0	0·7	5·3	1·05	17·5		11·6
12	0·8	8·1		36·0		4·5		17·5	0·9	11·5
13		8·3		36·0		3·7		17·5		11·5
14		8·5	1·4	35·0	0·6	3·0	1·05	17·5		11·5
15	0·82	8·8		35·0		2·7		17·5	0·9	11·5
16		11·0		35·0		2·5		17·5		11·5
17		13·0		35·0	0·55	2·2		17·5		11·5
18		15·0	1·4	35·0		1·9		17·5	0·9	11·5
19		17·0		34·0		1·6	1·05	17·5		11·3
20	1·1	20·0		33·0		1·3		17·5		11·1
21		20·7	1·35	32·0	0·47	1·1		17·5		11·0
22		21·3		32·4		1·0	1·05	17·5	0·88	10·8
23	1·15	22·0		32·8		0·8		17·5		10·7
24		22·5	1·37	33·2		0·7		17·5		10·6
25		23·0		32·7	0·42	0·6		17·5		10·5
26		23·5		32·2		0·6	1·05	17·5	0·87	10·5
27	1·2	24·0		31·7		0·6		17·5		10·5
28		24·8	1·32	31·2	0·42	0·6		17·5		10·5
29		25·6		30·5		0·5	1·05	17·5		10·5
30	1·25	26·5		29·8		0·5		16·7	0·87	10·5
31		26·5			0·4	0·4		15·9		

PAUL CREEK (BELOW PAUL LAKE.)

Location.—Northeast boundary Kamloops Indian Reserve No. 1.

Records Available.—July 1 to October 6, 1911; May 12 to September 25, 1912; May 18 to September 30, 1913.

Winter Conditions.—Stream usually becomes very low and freezes, or dries up completely during the winter.

Gauge.—Vertical staff gauge read at least once a week by E. R. Ridout.

Channel.—Channel is rocky and current very swift at high stages.

Discharge Measurements.—The gauge-height-discharge curve is fairly well defined, but owing to poor conditions for metering, the freshet flow is probably not deduced with the highest accuracy. The flow is artificially controlled by a dam on Paul Lake.

Accuracy.—With the exception of the flood period the accuracy of returns is high.

PAUL CREEK.

Paul creek has its source in township 20, range 14, west 6th meridian, at an elevation of 3,500 feet and, flowing in a westerly direction, discharges into the North Thompson river, near Kamloops, at an elevation of 1,140 feet. It is part of the North Thompson drainage; the drainage area, above the outlet of

Paul lake as measured from a Geological Survey map, dated 1895, scale 2 miles to 1 inch, is 110 square miles. The precipitation varies from 25 inches, in the hills at the source, to 10 inches at the mouth. Paul creek is a contentious irrigation stream, about 20 miles in length, varying from 5 to 25 feet in width, and from several inches to a foot in depth. The drainage basin of Paul creek is well timbered with British Columbia fir, and in the upper reaches, spruce and balm of gilead are to be found. The first record on the stream is held by the Indians of the Kamloops Indian reserve, and it is regrettable that this somewhat large share of the supply is not used to better advantage. Often at the height of the irrigation season, the Indian ditch may be seen discharging into the Thompson river, while their fertile land lies awaiting the water so necessary for successful production.

The surplus flow of the stream, after the Indians are supplied, is held by the Harper estate, 12 miles east of Kamloops on the South Thompson river. A dam has been built by them with the co-operation of the Indians on Paul lake for storage purposes, and is effective in impounding a good portion of the spring run-off of the drainage basin. The dam could, however, be much improved, and the whole run-off successfully stored.

In its upper reaches, Paul creek flows through several large marshes and hay meadows, which flood in the spring time. It has been suggested that if the channel of Paul creek were deepened as it passes through these meadows and marshes, evaporation would be materially decreased and the flow of Paul creek augmented.

The residents of upper Paul creek (east of Pinantan lake) can raise good crops in average years without the aid of irrigation, although water when judiciously applied is of much assistance.

Below Paul Lake.—The river station on Paul creek below Paul lake was established July 2, 1911, by C. G. Cline. The measuring section is in a flume just above the Harper estate, and I. R. diversion. A standard vertical staff gauge is located on the left bank 50 feet above the measuring section; all measurements are made by wading. This station was established to determine the flow from Paul lake.

Above Pinantan Lake—This station was established August 25, 1911, by C. G. Cline, but was abandoned at the end of the irrigation season of 1912. This station was unsatisfactory, as the stream overflowed its banks during high water.

Below Pinantan Lake.—This station was established June 13, 1912, by E. M. Dann. The measuring section is located on the down stream side of the highway bridge, 100 feet below the outlet of Pinantan lake; all measurements are made by wading. A standard vertical staff gauge is located on the down-stream side of the aforementioned bridge. This station was established to take the place of the one abandoned above the lake. Two measurements were taken in 1912. (See miscellaneous measurements on Paul creek.)

DISCHARGE MEASUREMENTS of Paul Creek below Paul Lake, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
May 7	H. J. E. Keys	1,057	5·5	5·0	7·8	2·40	39·2
" 28	E. M. Dann	268	5·5	8·2	11·0	2·70	90·7
Sept. 9	H. J. E. Keys	1,057	5·5	·76	6·6	1·65	5·0
" 16	Dann and Keys	1,057	6·0	3·4	1·8	1·59	[1]6·1

NOTE.—Gauge reader, E. R. Ridout.
[1] New measuring section.

MONTHLY DISCHARGE of Paul Creek, below Paul Lake, for 1913.

(Drainage area, 65 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
June	90	35	52·3	0·80	0·89	3,112
July	34	23	29	0·45	0·52	1,783
August	23	10	15	0·23	0·26	922
September	9	0·5	4·5	0·07	0·08	268

DAILY GAUGE HEIGHTS AND DISCHARGES of Paul Creek, below Paul Lake, for 1913.

Day.	May.		June.		July.		August.		September.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	....	2·7	90	....	34	....	23	....	9
2	....	....	....	86	....	34	....	23	....	9
3	....	....	....	82	....	34	2·1	22	....	9
4	....	....	....	77	....	33	....	21	....	8
5	....	....	....	73	....	33	....	21	....	8
6	....	....	....	69	2·3	32	....	20	....	8
7	....	....	....	64	....	32	....	20	1·65	7
8	....	....	2·6	60	....	32	....	19	....	7
9	....	....	....	58	....	32	....	19	....	6
10	....	....	....	56	....	32	2·0	18	....	6
11	....	....	....	55	....	31	....	18	....	5
12	....	....	....	53	....	31	....	17	....	5
13	....	....	....	52	2·25	30	....	17	....	4
14	....	....	....	50	....	30	....	16	1·5	3
15	....	....	2·5	48	....	30	....	16	....	3
16	....	....	....	47	....	29	....	15	....	3
17	....	....	....	46	....	29	1·9	14	....	3
18	2·6	60	....	44	....	28	....	14	....	3
19	....	58	....	43	....	28	....	13	....	3
20	....	56	....	42	2·2	27	....	13	....	3
21	....	55	....	40	....	27	....	12	1·45	2·5
22	....	53	2·4	39	....	27	....	12	....	2
23	....	52	....	39	....	26	....	12	....	2
24	....	50	....	38	....	26	1·8	11	....	2
25	2·5	48	....	38	....	25	....	11	....	1·5
26	....	54	....	37	....	25	....	11	....	1·5
27	....	60	....	37	2·15	24	....	11	....	1
28	....	66	....	36	....	24	....	10	1·3	0·5
29	....	72	2·35	35	....	24	....	10	....	....
30	....	78	....	35	....	24	....	10	....	....
31	....	84	....	....	....	23	1·75	10	....	....

PAUL CREEK (BELOW PINANTAN LAKE.)

Location.—Section 27, township 20, range 15, west 6th meridian.

Records Available.—June 1 to August 31, 1913.

Winter Conditions.—Stream generally freezes over during the winter months.

Gauge.—Vertical staff gauge read daily during the irrigation season by A. Pene.

Channel.—The channel varies in width from 3 to 15 feet. Together with Lloyd creek, this stream represents the chief source of supply for the Paul lake reservoir.

Discharge Measurements.—Three meterings only were taken and gauge-height-discharge curve is poorly defined.

Accuracy.—Very little reliance can be placed on the figures appended.

DISCHARGE MEASUREMENTS of Paul Creek below Pinantan Lake, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
May 6	H. J. E. Keys	1,057	12	12·4	1·3	1·57	16·3
Sept. 10	do	1,057	3	0·3	1·0	0·32	0·3
Oct. 6	do	1,057	3	0·3	1·0	0·30	0·3

MONTHLY DISCHARGE of Paul Creek below Pinantan Lake for 1913.

Month.	Discharge in Second-Feet.			Run-Off.
	Maximum.	Minimum.	Mean.	Total in acre-feet.
June	5·2	2·7	3·93	234
July	4·5	1·0	2·59	159
August	1·8	0·1	0·70	43

NOTE.—Accuracy "D".
During low water Pinantan lake is practically dammed by boards to preserve the fishing.

Daily Gauge Heights and Discharges of Paul Creek below Pinantan Lake, for 1913.

Day.	May.		June.		July.		August.		September.		October.	
	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	....	0·9	5·2	0·8	3·9	0·5	1·0	0·2	0·2	....	....
2	....	....	0·9	5·2	0·8	3·9	0·5	1·0	0·2	0·2	....	....
3	....	....	0·9	5·2	0·85	4·5	0·55	1·4	0·25	0·2	....	....
4	....	....	0·85	4·5	0·8	3·9	0·55	1·4	0·25	0·2	....	....
5	....	....	0·8	3·9	0·8	3·9	0·5	1·0	0·2	0·2	....	....
6	1·57	16·3	0·8	3·9	0·8	3·9	0·5	1·0	0·2	0·2	0·3	0·3
7	....	....	0·8	3·9	0·8	3·9	0·6	1·8	0·2	0·2	....	....
8	....	....	0·8	3·9	0·8	3·9	0·6	1·8	0·2	0·2	....	....
9	....	....	0·8	3·9	0·75	3·3	0·5	1·0	0·2	0·2	....	....
10	....	....	0·8	3·9	0·75	3·3	0·5	1·0	0·3	0·3	....	....
11	....	....	0·85	3·3	0·75	3·3	0·5	1·0	0·2	0·2	....	....
12	....	....	0·75	3·3	0·8	3·9	0·55	1·4	0·2	0·2	....	....
13	....	....	0·7	2·7	0·7	2·7	0·5	1·0	0·2	0·2	....	....
14	....	....	0·7	2·7	0·7	2·7	0·4	0·5	....	....	....	....
15	....	....	0·75	3·3	0·7	2·7	0·4	0·5	....	....	....	....
16	....	....	0·75	3·3	0·7	2·7	0·45	0·8	....	....	....	....
17	....	....	0·7	2·7	0·65	2·2	0·4	0·5	....	....	....	....
18	....	....	0·8	3·9	0·65	2·2	0·4	0·5	....	....	....	....
19	....	....	0·8	3·9	0·65	2·2	0·4	0·5	....	....	....	....
20	....	....	0·8	3·9	0·6	1·8	0·3	0·3	....	....	....	....
21	....	....	0·75	3·3	0·6	1·8	0·3	0·3	....	....	....	....
22	....	....	0·8	3·9	0·6	1·8	0·35	0·4	....	....	....	....
23	....	....	0·8	3·9	0·6	1·8	0·3	0·3	....	....	....	....
24	....	....	0·8	3·9	0·6	1·8	0·25	0·2	....	....	....	....
25	0·97	6·2	0·8	3·9	0·55	1·4	0·2	0·2	....	....	....	....
26	0·97	5·2	0·85	4·5	0·55	1·4	0·2	0·2	....	....	....	....
27	0·9	5·2	0·85	4·5	C·55	1·4	0·2	0·2	....	....	....	....
28	0·9	5·2	0·85	4·5	0·5	1·0	0·2	0·2	....	....	....	....
29	0·9	5·2	0·85	4·5	0·5	1·0	0·2	0·2	....	....	....	....
30	0·9	5·2	0·85	4·5	0·5	1·0	0·15	0·1	....	....	....	....
31	0·9	5·2	....	....	0·5	1·0	0·15	0·1	....	....	....	....

SHUSWAP RIVER.

Location.—The gauging section is located in township 18, range 9, west 6th meridian at the highway bridge at Enderby, B.C.

Records Available.—March to November, 1912; April to December, 1913.

Winter Conditions.—The thermometer seldom goes below —10°F. The snowfall at Enderby is not heavy; the river is generally frozen for about three months.

Gauge.—A vertical staff gauge is used and read by Mr. P. Mowatt, daily.

Channel.—The channel is straight for 100 yards at section. The rise and fall in the river each year is about 10 feet. No shift in control is as yet appreciable.

Discharge Measurements.—Ten well distributed measurements have been made during 1911-12-13. Measurements are made from cable and boat, except in high water, when they are made from bridge.

Accuracy.—Accurate gauge readings are obtained, the discharge measurement plot up well; these results are within 5 per cent except in high water, when they may not be more accurate than within 10 per cent.

Discharge Measurements of Shuswap River near Enderby, 1911-13.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
1911							
Aug. 25	C. E. Richardson	1,048	212	2,118	0·92	4·08	1,948
Oct. 7	do	1,048	204	1,890	0·69	3·15	1,300
1912							
Feb. 28	C. E. Richardson	1,047	180	1,680	0·35	1·90	587
May 20	C. E. R. & H. C. H.	1,048	283	4,970	2·31	10·65	11,400
June 16	C. E. Richardson	1,048	332	5,550	2·36	12·05	13,094
July 13	do	1,048	275	3,760	1·67	7·34	6,270
Sept. 7	do	1,048	245	3,156	1·04	4·60	3,270
1913							
June 5	J. A. Elliott	1,672	328	7,016	2·60	14·60	18,700
May 13	C. E. Richardson	1,048	250	2,570	2·18	7·55	5,610
Aug. 26	J. A. Elliott	1,672	230	2,630	1·23	5·20	3,230

Monthly Discharge of Shuswap River, near Enderby for 1913.

(Drainage area, 1,650 square miles).

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
April	5,660	603	2,712	1·64	1·83	161,000
May	14,300	4,150	7,258	4·40	5·07	446,000
June	21,800	13,400	17,443	10·57	11·80	1,040,000
July	13,600	5,380	9,106	5·52	6·36	560,000
August	5,240	2,810	3,789	2·29	2·64	233,000
September	3,160	2,180	2,773	1·68	1·87	165,000
October	2,080	1,720	1,957	1·18	1·36	120,000
November	1,980	1,560	1,746	1·06	1·18	104,000
December	1,560	965	1,240	0·75	0·86	76,200

Daily Gauge Heights and Discharges of Shuswap River near Enderby for 1913.

Day.	April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	1·9	603	6·6	5,100	12·9	15,200
2	1·9	603	6·4	4,820	13·4	16,100
3	1·9	603	6·3	4,680	13·9	17,000
4	1·9	603	6·1	4,410	14·2	17,600
5	2·0	650	6·0	4,280	14·6	18,300
6	2·2	749	5·9	4,150	14·6	18,300
7	2·3	801	5·9	4,150	14·7	18,500
8	2·3	801	5·9	4,150	14·9	18,900
9	2·4	855	6·3	4,680	15·1	19,300
10	2·5	910	6·7	5,240	15·4	19,900
11	2·9	1,140	6·9	3,520	15·7	20,500
12	3·3	1,410	7·2	5,940	15·9	20,900
13	3·7	1,720	7·4	6,130	16·1	21,300
14	4·1	2,080	7·7	6,660	16·3	21,800
15	4·2	2,180	7·8	6,800	15·9	20,900
16	4·3	2,280	8·0	7,100	15·6	20,300
17	4·7	2,700	8·0	7,100	15·2	19,500
18	5·0	3,040	8·1	7,250	14·6	18,300
19	5·3	3,400	8·1	7,250	14·0	17,200
20	5·6	3,760	8·1	7,250	13·8	16,800
21	5·9	4,150	8·2	7,390	13·5	16,300
22	6·2	4,540	8·4	7,690	13·3	15,900
23	6·2	4,540	8·6	7,990	13·1	15,600
24	6·3	4,680	8·7	8,140	12·8	15,000
25	6·6	5,100	9·2	8,930	12·6	14,700
26	7·0	5,660	9·7	9,720	12·4	14,300
27	7·0	5,660	10·2	10,500	12·3	14,100
28	6·9	5,520	10·8	11,600	12·1	13,800
29	6·8	5,380	11·4	12,600	12·0	13,600
30	6·7	5,240	11·9	13,400	11·9	13,400
31	....	....	12·4	14,300	....	....

DAILY GAUGE HEIGHTS AND DISCHARGES of Shuswap River, near Enderby for 1913.—*Continued.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	12·0	13,600	6·7	5,240	4·7	2,700	4·1	2,080	4·0	1,980	3·5	1,560
2	11·9	13,400	6·5	4,960	4·6	2,590	4·1	2,080	4·0	1,980	3·5	1,560
3	11·7	13,100	6·4	4,820	4·7	2,700	4·0	1,980	4·0	1,980	3·4	1,480
4	11·4	12,600	6·2	4,540	5·0	3,040	4·0	1,980	3·9	1,890	3·4	1,480
5	11·1	12,000	6·1	4,410	5·1	3,160	4·0	1,980	4·0	1,980	3·4	1,480
6	10·7	11,400	6·0	4,280	5·1	3,160	3·9	1,890	4·0	1,980	3·3	1,410
7	10·7	11,400	5·9	4,150	5·1	3,160	3·8	1,800	4·0	1,980	3·3	1,410
8	10·4	10,900	5·9	4,150	5·1	3,160	3·8	1,800	4·0	1,980	3·3	1,410
9	10·2	10,500	5·8	4,020	5·1	3,160	3·8	1,800	3·9	1,890	3·2	1,340
10	10·0	10,200	5·8	4,020	5·1	3,160	3·7	1,720	3·9	1,890	3·2	1,340
11	9·9	10,000	5·7	3,890	5·1	3,160	3·8	1,800	3·9	1,890	3·2	1,340
12	9·7	9,720	5·6	3,760	5·1	3,160	3·8	1,800	3·9	1,890	3·1	1,270
13	9·6	9,560	5·6	3,760	5·1	3,160	3·8	1,800	3·9	1,890	3·1	1,270
14	9·5	9,400	5·6	3,760	5·0	3,040	4·0	1,980	3·8	1,800	3·1	1,270
15	9·6	9,560	5·6	3,760	4·9	2,920	4·0	1,980	3·8	1,800	3·0	1,210
16	9·4	9,240	5·6	3,760	4·9	2,920	4·0	1,980	3·8	1,800	3·0	1,210
17	9·2	8,930	5·5	3,640	4·8	2,810	4·0	1,980	3·7	1,720	3·0	1,210
18	9·0	8,620	5·6	3,760	4·7	2,700	4·0	1,980	3·7	1,720	3·0	1,210
19	8·8	8,300	5·6	3,760	4·7	2,700	4·0	1,980	3·7	1,720	3·0	1,210
20	8·5	7,840	5·6	3,760	4·7	2,700	4·0	1,980	3·6	1,640	2·9	1,140
21	8·4	7,690	5·5	3,640	4·6	2,590	4·1	2,080	3·6	1,640	2·9	1,140
22	8·2	7,390	5·4	3,520	4·6	2,590	4·0	1,980	3·6	1,640	2·9	1,140
23	8·1	7,250	5·4	3,520	4·6	2,590	4·0	1,980	3·6	1,640	2·9	1,140
24	7·9	6,950	5·3	3,400	4·5	2,480	4·0	1,980	3·6	1,540	2·8	1,080
25	7·8	6,800	5·2	3,280	4·4	2,380	4·1	2,080	3·6	1,640	2·8	1,080
26	7·6	6,520	5·1	3,160	4·4	2,380	4·1	2,080	3·6	1,640	2·8	1,080
27	7·4	6,130	5·1	3,160	4·3	2,280	4·1	2,080	3·5	1,560	2·8	1,080
28	7·3	6,080	5·0	3,040	4·3	2,280	4·1	2,080	3·5	1,560	2·7	1,020
29	7·2	5,940	4·9	2,920	4·2	2,180	4·0	1,980	3·5	1,560	2·7	1,020
30	7·1	5,800	4·8	2,810	4·2	2,180	4·0	1,980	3·5	1,560	2·6	965
31	6·8	5,380	4·8	2,810	....	....	4·0	1,980	....	....	2·6	965

SHUSWAP RIVER AT COTEAU FALLS.

Location.—At Highway bridge crossing below Coteau Falls near Lumby, B.C.

Records Available.—Complete records have been taken by Coteau Power Company and C. N. R. engineers during 1912 and 1913. Through their courtesy these records for 1913 have been made available.

Gauge.—Vertical staff gauge with standard enamel facings. Gauge readings obtained daily by R. H. Spurling, C.E.

Channel.—Varying in width from 70 feet at low water to 150 feet at high water. The jamming of logs on a gravel bar below the gauge is a cause of possible backwater.

Discharge Measurements.—The company's engineer obtains a metering at every appreciable change of stage. A check measurement on his results by British Columbia Hydrographic engineers showed a discrepancy of 6 per cent.

Accuracy.—Further check measurements will be made during 1914, Accuracy is probably very high since obviously great care is taken in obtaining results.

MONTHLY DISCHARGE of Shuswap River near Coteau Falls for 1913.

(Drainage area, 640 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
January	530	336	382	·60	·69	23,488
February	478	382	412	·64	·67	22,881
March	417	371	388	·61	·70	23,857
April	2,730	374	1,405	2·20	2·45	83,600
May	9,200	1,605	3,925	6·13	7·07	241,340
June	13,276	6,280	8,778	13·72	15·31	523,330
July	6,150	2,600	4,288	6·70	7·72	263,660
August	23,74	1,470	2,070	3·23	3·72	127,280
September	25,28	1,079	1,528	2·39	2·67	90,920
October	1,350	900	1,139	1·78	2·05	70,040
November	1,160	728	887	1·39	1·55	52,780
December	710	455	541	·85	·98	33,265
The year	13,276	336	2,145	3·36	45·58	1,555,41

DAILY GAUGE HEIGHTS AND DISCHARGES of Shuswap River near Cotean Falls for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	530	....	345	....	417	....	374	....	1,870	....	9,400
2	....	530	....	382	....	417	....	374	....	1,805	....	10,198
3	....	487	....	438	....	417	....	374	....	1,710	....	10,400
4	....	455	....	418	....	417	....	374	....	1,675	....	11,700
5	....	413	....	393	....	395	....	384	....	1,605	....	10,570
6	....	395	....	383	....	395	....	425	....	1,620	....	9,840
7	....	435	....	383	....	395	....	412	....	1,610	....	9,310
8	....	482	....	383	....	395	....	412	....	1,705	....	9,650
9	....	455	....	383	....	395	....	420	....	1,975	....	11,780
10	....	382	....	383	....	405	....	463	....	2,595	....	13,275
11	....	336	....	383	....	413	....	563	....	2,975	....	13,276
12	....	337	....	383	....	382	....	757	....	3,330	....	12,475
13	....	340	....	383	....	376	....	1,065	....	3,983	....	10,945
14	....	340	....	395	....	372	....	1,247	....	4,020	....	10,678
15	....	340	....	417	....	375	....	1,440	....	3,930	....	9,335
16	....	343	....	435	....	376	....	1,475	....	3,720	....	8,160
17	....	351	....	476	....	395	....	1,670	....	3,590	....	6,913
18	....	355	....	455	....	407	....	1,880	....	3,440	....	6,334
19	....	343	....	455	....	388	....	2,160	....	3,330	....	6,300
20	....	340	....	455	....	378	....	2,320	....	3,400	....	6,788
21	....	351	....	393	....	373	....	2,550	....	3,440	....	7,460
22	....	355	....	478	....	376	....	2,730	....	3,753	....	7,310
23	....	355	....	455	....	376	....	2,595	....	4,020	....	6,595
24	....	355	....	435	....	378	....	2,458	....	4,760	....	6,430
25	....	352	....	417	....	376	....	2,430	....	5,475	....	6,430
26	....	352	....	417	....	376	....	2,315	....	6,000	....	6,430
27	....	352	....	406	....	378	....	2,280	....	6,375	....	6,280
28	....	352	....	395	....	373	....	2,220	....	7,790	....	6,360
29	....	348	....	....	....	371	....	2,024	....	8,320	....	6,356
30	....	345	....	....	....	371	....	1,957	....	8,660	....	6,356
31	....	345	....	....	....	374	....	....	....	9,200	....	....

DAILY GAUGE HEIGHTS AND DISCHARGES of Shuswap River near Coteau Falls, for 1913.—*Continued.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	6,150	....	2,374	....	1,415	....	1,050	....	1,127	....	710
2	....	5,910	....	2,310	....	1,401	....	1,040	....	1,160	....	688
3	....	5,616	....	2,270	....	1,352	....	999	....	1,060	....	651
4	....	5,460	....	2,310	....	1,800	....	960	....	1,023	....	545
5	....	5,108	....	2,310	....	2,200	....	960	....	1,050	....	640
6	....	4,770	....	2,310	....	2,528	....	945	....	1,050	....	625
7	....	5,114	....	2,270	....	2,380	....	930	....	1,042	....	615
8	....	5,400	....	2,270	....	2,200	....	920	....	1,034	....	600
9	....	5,204	....	2,506	....	1,958	....	920	....	1,020	....	580
10	....	5,100	....	2,520	....	1,860	....	900	....	1,020	....	565
11	....	4,950	....	2,250	....	1,730	....	920	....	990	....	548
12	....	4,566	....	2,210	....	1,530	....	1,010	....	940	....	548
13	....	4,450	....	2,210	....	1,539	....	1,165	....	873	....	548
14	....	4,340	....	2,190	....	1,475	....	1,280	....	840	....	548
15	....	4,250	....	2,190	....	1,420	....	1,290	....	825	....	548
16	....	4,020	....	2,130	....	1,350	....	1,300	....	840	....	540
17	....	3,910	....	2,030	....	1,287	....	1,280	....	825	....	530
18	....	3,900	....	2,067	....	1,294	....	1,225	....	825	....	530
19	....	3,620	....	2,130	....	1,350	....	1,225	....	778	....	505
20	....	3,620	....	2,090	....	1,364	....	1,240	....	790	....	478
21	....	3,725	....	2,067	....	1,300	....	1,240	....	776	....	475
22	....	3,900	....	1,990	....	1,420	....	1,200	....	776	....	475
23	....	3,900	....	1,900	....	1,360	....	1,200	....	755	....	475
24	....	3,900	....	1,812	....	1,310	....	730	....	730	....	470
25	....	3,750	....	1,812	....	1,265	....	1,330	....	740	....	460
26	....	3,600	....	1,750	....	1,230	....	1,350	....	740	....	465
27	....	3,410	....	1,675	....	1,167	....	1,287	....	765	....	465
28	....	3,020	....	1,670	....	1,150	....	1,273	....	755	....	465
29	....	2,850	....	1,548	....	1,130	....	1,250	....	728	....	465
30	....	2,820	....	2,530	....	1,079	....	1,148	....	740	....	455
31	....	2,600	....	1,470	....	....	....	1,140	....	....	....	465

SCOTTIE CREEK.

Location.—Section 16, township 23, range 25, west 6th meridian, north of Ashcroft, B.C., and tributary to the Bonaparte river.

Records Available.—June 1 to October 31, 1911; April 1 to September 8, 1912; May 1 to November 28, 1913.

Winter Conditions.—Conditions throughout the winter are similar to those obtained at Ashcroft. There is however, a slightly higher snowfall. Under ordinary circumstances the stream freezes up during the winter months.

Gauge.—Standard vertical staff gauge installed above diversions. Readings made daily during the irrigation season by A. G. Hunter.

Channel.—At measuring section the water is sluggish owing to effect of dam below. The gauge is above all influence of backwater. The stream is 15 to 20 feet in width and the control is good.

Discharge Measurements.—The gauge-height-discharge curve is fairly well defined, but during the freshet the necessity for a stilling box at the gauge was felt.

Accuracy.—Accuracy of returns shown is only fair.

SCOTTIE CREEK.

Scottie creek has its source in the Arrowhead hills, at an elevation of 5,000 feet, and discharges into the Bonaparte river from the east, near 19 mile post on the Cariboo road, at an elevation of 1,600 feet. It is part of the Thompson-Fraser drainage. Its drainage area above the mouth is 73 square miles. and the gauging station is near the mouth. The water is used for irrigation, and the supply is usually insufficient. Water from Scottie creek was used for placer mining at one time.

The drainage basin of Scottie creek is very rough, with no agricultural land. There are canyons on the stream in places, and the fall is quite heavy. There is a wagon road for only half a mile up the creek, with a pack trail for several miles farther. There was a placer mine in the valley at one time, but it has been abandoned. There are indications of mineral in the vicinity. There is some timber in the valley, but it is mostly small and its main use would be to conserve the moisture and prevent erosion. Most of the land in the watershed will be used for nothing but grazing.

At one of the canyons a storage dam might be constructed to store surplus flood waters for use in the latter part of the irrigation season. The canyon is said to be 30 feet deep and 20 feet wide with a good basin behind it.

Scotttie creek is in the dry belt. The precipitation is from 8 to 10 inches The weather is hot in summer and cold in winter.

The gauge on Scottie creek is near the mouth, just above Walker's diversion. Since the station was established Hunter has dug a ditch above it, and was diverting water through it during part of July and August, 1912. The station was established on June 6, 1911, and the gauge readings were taken twice a day during the irrigation seasons of 1911 and 1912 and 1913. The gauge is a 5-foot cedar staff securely nailed to a tree stump on the left bank of the creek about 200 feet above Walker's diversion, and just behind Hunter's stable. The meter measurements are made by wading at a section 50 feet below the gauge. The stream above the section is rapid, and below the section it is backed up by the diversion dam. The banks are high enough to prevent overflowing, and are covered with bushes. The bed of the stream is rocky in the rapids with a deposit of mud in the quieter water at the dam. The influence of the dam does not extend to the gauge. It is hard to read the gauge accurately at high water. The general level of the water near the gauge should be taken, not the point to which the water backs up. The bank is undercut at the gauge, but it does not seem to effect the accuracy.

Discharge Measurements of Scotttie Creek, above Walker's Diversion, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Apr. 30	Chisholm & Cline	1,055	17	10·50	1·3	0·95	14
May 24	K. G. Chisholm	1,055	18	15·45	1·64	1·27	25
May 26	do	1,055	18	14·05	1·77	1·27	25
Aug. 1	do	1,055	15	6·94	1·13	0·81	7·9

Monthly Discharge of Scottie Creek above Walker's Diversion for 1913.

(Drainage area, 73 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May	41·5	13·0	22·8	·31	·36	1,402
June	22·5	9·5	12·6	·17	·19	750
July	28·8	10·2	15·3	·21	·24	941
August	16·2	7·1	9·7	·13	·15	596
September	10·2	7·1	7·7	·10	·12	458
October	10·2	8·1	8·4	·11	·13	516
November	9·0	7·1	7·2	·10	·11	428
The period	138·4	62·1	12·0	·16	1·30	5,091

Daily Gauge Heights and Discharges of Scottie Creek above Walker's Diversion for 1913.

Day.	April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	....	1·0	14·7	1·07	15·9
2	....	....	0·95	13·0	1·07	15·9
3	....	....	0·95	13	1·02	15·3
4	....	....	0·97	13·7	·95	13
5	....	....	0·97	13·7	·95	13
6	....	....	1·0	14·7	·92	12·1
7	....	....	1·0	14·7	·9	11·5
8	....	....	1·02	15·3	·9	11·5
9	....	....	1·35	25·6	·9	11·5
10	....	....	1·85	41·5	·9	11·5
11	....	....	1·65	35·1	·87	10·7
12	....	....	1·65	35·1	·85	10·2
13	....	....	1·65	35·1	·85	10·2
14	....	....	1·65	35·1	·85	10·2
15	....	....	1·45	28·8	·85	10·2
16	....	....	1·35	25·6	·82	9·5
17	....	....	1·35	25·6	·82	9·5
18	....	....	1·35	25·6	·82	9·5
19	....	....	1·35	25·6	·82	9·5
20	....	....	1·3	24·1	·82	9·5
21	....	....	1·3	24·1	·82	9·5
22	....	....	1·3	24·1	·82	9·5
23	....	....	1·25	22·5	·82	9·5
24	....	....	1·25	22·5	·82	9·5
25	....	....	1·25	22·5	·87	10·7
26	....	....	1·22	21·5	1·05	16·2
27	....	....	1·22	21·5	1·15	19·4
28	....	....	1·2	20·9	1·1	17·8
29	....	....	1·15	19·3	1·25	22·5
30	....	....	1·10	17·8	1·25	22·5
31	1·00	....	1·07	15·9	....	....

Daily Gauge Heights and Discharges of Scottie Creek above Walker's Diversion for 1913.—*Continued.*

Day.	July.		August.		September.		October.		November.	
	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	1·10	17·8	·82	9·5	·7	7·1	75	8·1	·75	8·1
2	1·02	15·3	·82	9·5	·7	7·1	75	8·1	·75	8·1
3	1·02	15·3	·82	9·5	·7	7·1	77	8·4	·65	6·2
4	1·02	15·3	·8	9·0	·7	7·1	75	8·1	·65	6·2
5	1·0	14·6	·75	8·1	·7	7·1	75	8·1	·7	7·1
6	·95	13·0	·75	8·1	·7	7·1	75	8·1	·75	8·1
7	·95	13·0	·75	8·1	·7	7·1	75	8·1	·85	10·2
8	·95	13·0	·75	8·1	·7	7·1	75	8·1	·85	10·2
9	·92	12·1	·75	8·1	·7	7·1	75	8·1	·75	8·1
10	·9	11·5	75	8·1	·7	7·1	75	8·1	·75	8·1
11	·85	10·2	·75	8·1	·7	7·1	75	8·1	·65	5·7
12	·9	11·5	·75	8·1	·7	7·1	80	9·0	·55	4·7
13	1·05	16·2	·85	10·2	·7	7·1	·80	9·0	·55	4·7
14	1·35	25·6	·85	10·2	·7	7·1	·77	8·4	·55	4·7
15	1·35	25·6	·82	9·5	·7	7·1	·75	8·1	·75	8·1
16	1·45	28·8	·80	9·0	·7	7·1	·75	8·1	·75	8·1
17	1·27	23·1	·85	10·2	·7	7·1	·75	8·1	·75	8·1
18	1·27	23·1	·95	13·0	·7	7·1	·8	9·0	·55	4·7
19	1·25	22·5	1·1	17·8	·7	7·1	·8	9·0	·75	8·1
20	1·2	20·9	1·05	16·2	·7	7·1	·8	9·0	·55	4·7
21	1·05	16·2	·97	13·7	·75	8·1	·75	8·1	·75	8·1
22	·95	13·0	·90	11·5	·85	10·2	·75	8·1	·65	6·2
23	·92	12·1	·90	11·5	·85	10·2	·75	8·1	·55	4·7
24	·92	12·1	·85	10·2	·82	9·5	·75	8·1	·75	8·1
25	·85	10·2	·82	9·5	·80	9·0	·75	8·1	·75	8·1
26	·85	10·2	·75	8·1	·77	8·4	·85	10·2	·75	8·1
27	·85	10·2	·75	8·1	·75	8·1	·85	10·2	·8	9·0
28	·85	10·2	·75	8·1	·75	8·1	·75	8·1	....	....
29	·85	10·2	·72	7·5	·75	8·1	·75	8·1	....	....
30	·85	10·2	·7	7·1	·75	8·1	·75	8·1	....	....
31	·85	10·2	·7	7·1	....	....	·75	8·1	....	....

SPIUS CREEK.

Location.—Section 15, township 13, range 23, west 6th meridian.

Records Available.—August 18 to November 22, 1911; May 8 to September 12, 1912; May 25 to November 30, 1913.

Winter Conditions.—Ice conditions exist from November to February under normal conditions. There are several cold periods usually of short duration.

Gauge.—Chain gauge established on March 18, 1914, to replace staff gauges which gave unsatisfactory results. The gauge height is read daily by George A. Longbottom.

Channel.—The channel is of rocks and boulders and the velocity of the current is high, even at low water.

Discharge Measurements.—Numerous meterings have been obtained, but it will be necessary to have the new gauge completely rated during 1914.

Accuracy.—The accuracy of results obtained from discharge curves during the past three years is low, and only slight dependence may be placed on them.

SPIUS CREEK.

Spius creek has its source in mountains near township 11, range 23, west 6th meridian, at an elevation of 4,000 feet and flowing due north for 25 miles, discharges into Nicola river, near the Railway Belt boundary, at an elevation of 1,800 feet. It is part of the Nicola-Thompson drainage; the drainage area, as measured from a Dominion sectional map, scale 3 miles to an inch, is 344 square

miles. The stream is used for both lumbering and irrigation. It is a stream varying from 25 to 100 feet in width, from 2 to 10 feet in depth, and with a mean velocity of from 1.5 to 5 feet per second. There is a very large freshet in May. The bed of the stream is generally rocky, and at times it passes through canyons and over small falls. The valley of the creek varies from one-fourth of a mile to 1 mile in width, and contains good agricultural land, for which irrigation is necessary, the precipitation not exceeding 20 inches, excepting very near the source. Considerable land is also taken up along Prospect creek, a large tributary entering from the west, about 10 miles from the mouth. Several timber limits are held along Spius creek about 5 miles from the mouth, by the Nicola Valley Pine Lumber Company. This company established a mill 1 mile up the creek; constructing a timber, rock filled dam, 40 feet high, which affords them a log pond of 25 acres. Logs are driven down the creek during the freshet in May and June.

The first station was established on August 15, 1911, by C. E. Richardson. This station was abandoned at the end of the 1911 season on account of a dam put in by the Nicola Valley Pine Lumber Company, causing back water, and a new gauge put in below the dams by C. E. Richardson on May 22, 1912. On June 22, C. G. Cline moved this gauge up-stream because of interference from irrigation ditchhead works. B. Corbould put in another new gauge in August 14, 1912, which was carried away by a freshet on November 9. Mr. Keys put in a new staff gauge on May 26, 1913, which was again carried away by a freshet. Mr. Keys then established a chain gauge at Longbottom's ranch, 2 miles from the stream's mouth in August, 1913. This was found to be unreliable, so it was replaced by a new chain gauge installed by Mr. Chisholm, on March 18, 1914.

DISCHARGE MEASUREMENTS of Spius Creek at Longbottom's Ranch, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Aug. 1......	H. J. E. Keys................	1,057	72	85	1·6	6·0	132
" 21......	do	1,057	80	44	2·1	5·8	[1]94·6

NOTE.—[1] Different section.

MONTHLY DISCHARGE of Spius Creek, near Canford, for 1913.

(Drainage area, 344 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
June..............................	535	40	171	0·50	0·56	10,200
July..............................	265	43	131	0·38	0·44	8,050
August..............................	564	123	200	0·58	0·65	11,900
September..............................	304	123	192	0·55	0·63	11,800
October..............................	218	132	162	0·46	0·51	9,640

NOTE.—Accuracy "D".
A gauge was established below dam in same position as former gauge in May. But pier to which gauge was fastened was torn out. Finally a chain gauge was established about 2 miles above dam on August 1. This gauge was found unsatisfactory and was replaced by a new chain gauge on March 18, 1914.

Spius Creek—Metering Station.

Daily Gauge Heights and Discharges of Spius Creek, near Canford, for 1913.

Day.	May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	....	3·0	535
2	....	....	3·0	535
3	....	....	3·0	535
4	....	....	3·0	535
5	....	....	2·25	200
6	....	....	2·25	200
7	....	....	2·25	200
8	....	....	2·25	200
9	....	....	2·5	290
10	....	....	2·25	200
11	....	....	2·05	142
12	....	....	2·25	200
13	....	....	2·3	215
14	....	....	2·0	130
15	....	....	1·55	65
16	....	....	1·5	60
17	....	....	1·4	50
18	....	....	1·4	50
19	....	....	1·75	88
20	....	....	1·8	95
21	....	....	1·6	70
22	....	....	1·6	70
23	....	....	1·6	70
24	....	....	1·7	80
25	2·35	232	1·7	80
26	2·5	290	1·4	50
27	3·0	535	1·3	40
28	3·0	535	1·35	45
29	2·5	290	....	45
30	2·75	405	....	45
31	2·7	380	....	....

Daily Gauge Heights and Discharges of Spius Creek, near Canford, for 1913—*Continued.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	....	6·0	132	6·0	132	6·0	132	6·1	150	....	....
2	....	....	....	132	5·95	123	6·0	132	6·05	141	....	....
3	....	....	....	132	6·1	150	5·95	123	6·0	132	....	....
4	....	....	6·0	132	8·17	564	5·95	123	6·0	132	....	....
5	....	....	6·0	132	7·5	425	5·95	123	6·0	132	....	....
6	....	....	6·0	132	6·8	284	6·0	132	6·1	150	....	....
7	....	....	6·0	132	6·65	256	6·0	132	6·15	159	....	....
8	....	....	6·05	141	6·65	237	6·05	141	6·2	168	....	....
9	....	....	6·0	132	6·55	237	6·1	150	6·2	168	....	....
10	....	....	5·5	43	6·45	218	6·6	246	6·2	168	....	....
11	....	....	5·5	43	6·4	208	6·7	265	6·2	168	....	....
12	....	....	6·7	265	6·35	198	6·9	304	6·2	168	....	....
13	....	....	6·5	227	6·35	198	6·9	304	6·2	168	....	....
14	....	....	6·0	132	6·35	198	6·6	246	6·15	159	....	....
15	....	....	5·7	78	6·3	188	6·5	227	ice.	189	....	....
16	....	....	5·7	78	6·25	178	6·5	227	6·45	218	....	....
17	....	....	6·05	141	6·25	178	6·4	208	6·35	198	....	....
18	....	....	6·17	163	6·25	178	6·4	208	6·25	168	....	....
19	....	....	6·15	159	6·2	168	6·4	208	6·2	168	....	....
20	....	....	6·1	150	6·15	159	6·4	208	6·2	168	....	....
21	....	....	6·05	141	6·15	159	6·4	208	6·15	159	....	....
22	....	....	6·05	141	6·15	159	6·4	208	6·1	150	....	....
23	....	....	6·0	132	6·15	159	6·45	218	6·1	150	....	....
24	....	....	6·0	132	6·15	159	6·45	218	6·15	159	....	....
25	....	....	6·0	132	6·15	159	3·4	208	6·2	168	....	....
26	....	....	6·0	132	6·1	150	6·35	198	6·15	159	....	....
27	....	....	5·95	123	6·1	150	6·3	188	6·15	159	....	....
28	....	....	5·9	113	6·1	150	6·25	178	6·15	159	....	....
29	....	....	5·9	113	6·05	141	6·2	168	6·15	159	....	....
30	....	....	5·9	113	6·0	132	6·2	168	6·15	159	....	....
31	....	....	5·95	123	....	....	6·15	159	....	....	....	....

STEIN CREEK.

Location.—At highway bridge, near mouth, in section 27, township 15, range 27, west of 6th meridian,

Records Available.—September 22 to December 23, 1911; January 14 to November 24, 1912; April 11 to August 31, 1913.

Winter Conditions.—Open water at gauge all year.

Gauge.—Vertical staff gauge. Also auxiliary chain gauge on bridge. Gauge readings about once a week.

Channel.—Rocks and Boulders—eddies at certain stages.

Discharge Measurements.—One measurement in 1911, three in 1912, and one in 1913 show fair agreement but do not cover the bigger freshets.

Accuracy.—The infrequency of the gauge readings impairs the reliability of the records.

STEIN CREEK.

Stein creek has its source in the mountains surrounding Mountain Stein, at an elevation of 5,000 feet, and flowing in an easterly direction for a distance of 30 miles, discharges into the Fraser river near Lytton at an elevation of 500 feet. It is part of the Fraser drainage; the drainage area, as measured from a Dominion sectional map, scale 3 miles to 1 inch, is 130 square miles.

The precipitation at the mouth is small, not exceeding 20 inches, but at the source on the eastern mountains of the Coast range, the precipitation, both rain and snow, is heavy, from 50 to 70 inches.

The maximum discharge in 1912 amounted to 3,000 second-feet on June 30; the minimum flow was 80 second-feet on the 10th of March. The stream is generally about 50 feet wide, from 2 to 10 feet deep, and varying in velocity from 1.5 to 8 feet per second. The valley is rough and broken, covered with underbrush and scattered timber. The stream is swift and turbulent, rushing in and out of canyons, and over rapids and falls. The drop in the last 20 miles of the river is at the rate of 150 feet per mile.

Through this district the hunting is excellent and the fishing unexcelled. Stein creek was prospected years ago, and a trail still runs practically to the source, but it presents great difficulties to travellers.

Stein creek is used at the present time for irrigation purposes. Records to the extent of 1,000 inches have been taken out, appurtenant to lands in the vicinity along the valley of the Fraser.

The C.P.R. investigated Stein creek regarding water-power possibilities. The chief objection to any power development on Stein creek is the lack of storage. Good summer power may be obtained.

The hydrographic station on Stein creek was established on September 22, 1913, by C. E. Richardson. The measuring section is located on the downstream side of the highway bridge, about half a mile from the mouth, and 3 miles from the Fraser river ferry above Lytton. All measurements are made by suspending the meter from a cable. A standard vertical staff gauge is fastened to the cribbing of the right abutment, on the downstream side. In the spring of 1912 a chain gauge was established, for use during high water; the datum of both gauges is the same, and is referred to three bench-marks.

DISCHARGE MEASUREMENTS of Stein Creek near Mouth, 1911, 1912 and 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1911.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
ept. 22......	C. E. Richardson............	1,048	57	203	3·4	0·60	685
1912.							
March 27......	C. G. Cline..................	1,046	38	121	1·3	−1·00	[1]152
May 30......	C. G. C. & B. C............	1,046	55	279	4·9	1·75	1,360
July 26......	C. G. Cline..................	1,046	50	250	4·8	1·70	1,190
1913.							
Sept. 6......	C. G. C. & K. G. C..........	1,055	50	251	4·8	1·55	1,195

NOTE.—[1] Below zero of gauge.

MONTHLY DISCHARGE of Stein creek near Mouth for 1913.

(Drainage area, 130 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
April	690	500	585	4·5	5·02	34,800
May	2,970	630	1,659	12·7	14·6	102,030
June	4,800	1,890	2,817	21·6	24·1	167,000
July	2,110	1,480	1,791	13·8	15·9	110,000
August	1,660	790	1,251	9·6	11·1	76,900

DAILY GAUGE HEIGHTS AND DISCHARGES of Stein creek near Mouth for 1913.

Day.	April.		May.		June.		July.		August.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1		500		630		3,200		2,020	2·3	1,660
2		500		640		3,500		2,030		1,630
3		500	0·5	640		3,800	2·9	2,040		1,600
4		500		700		4,200		2,060		1,570
5		500		760		4,500		2,080		1,540
6		500		820	7·0	4,800	3·0	2,110		1,500
7		500		880		4,500		2,080		1,480
8		500		940		4,200		2,040		1,450
9		500		1,000		3,900		2,040	1·9	1,420
10		500		1,060		3,500		2,020		1,380
11	0·30	550	1·4	1,120		3,200		2,000		1,340
12		560		1,210		2,800	2·8	1,980		1,310
13		580		1,300		2,600	2·8	1,980		1,280
14		600		1,390		2,300		1,900		1,250
15		620		1,480	2·8	1,980		1,830		1,220
16		640		1,570		2,040		1,760	1·5	1,180
17		660	2·3	1,660		2,090		1,690		1,200
18		670		1,760		2,140		1,620		1,220
19		680		1,860		2,190		1,550	1·6	1,240
20	0·60	690		1,960	3·2	2,240	2·0	1,480		1,200
21		670		2,060		2,210		1,500		1,170
22		660		2,160		2,170		1,510		1,140
23		650		2,270		2,130		1,520		1,100
24		640	3·4	2,370		2,100		1,540	1·3	1,070
25	0·45	620		2,470		2,070		1,550		1,100
26	0·45	620		2,570		2,040		1,560	1·4	1,120
27	0·40	600		2,670	2·8	1,980		1·570		1,030
28		600	4·0	2,760		2,000		1,580		940
29		610		2,830	2·85	2,010	2·2	1,600	0·9	840
30		620		2,900		2,020		1,620		820
31			4·3	2,970				1,640	0·8	790

THOMPSON RIVER AT SPENCES BRIDGE.

Location.—Section 2, township 17, range 25, west 6th meridian.

Records Available.—October 25 to December 31, 1911; January 1 to December 31, 1912; January 1 to December 31, 1913.

Winter Conditions.—There are some short cold periods as a rule, but the river usually remains open throughout the year.

Gauge.—The gauge is a chain gauge with graduations marked on bridge rail. Daily readings are made by Miss Violet Curnow.

Channel.—The channel varies from 400 to a little over 500 feet in width, the flow ranging from 4,000 second-feet at low water to 110,000 second-feet at high stages. At high water the stream is 16 feet deeper than at low, while mean velocities range from 2 feet per second to 11 feet per second.

Discharge Measurements.—Measurements are made by cable suspension from the upstream side of traffic bridge spanning the river at the town of Spences Bridge. Owing to the extremely high velocities at high stages meterings are very difficult to obtain. However, the discharge-gauge-height curve is well defined.

Accuracy.—Results for 1913 bear a high degree of accuracy and are considered to be within 5 per cent of the truth.

Thompson River at Spences Bridge. (Metering Station.)

Thompson river from Kamloops to Lytton is 74 square miles.

(1) The North Thompson river rises at an elevation of 4,000 to 6,000 feet, about 10 miles south of Tête Jaune Cache. It might be noted here that within a radius of 5 miles may be found the source of the Fraser, the Canoe (a large tributary of the Columbia river) and the North Thompson river, the three streams which drain practically the whole of British Columbia. From its source, the North Thompson river flows south to Kamloops, where it joins the South Thompson river. The valley of the North Thompson is being opened up by the Canadian Northern Pacific railway, which runs beside the river from Tête Jaune Cache to Kamloops.

The mineral wealth of the country in this drainage is still unknown. Mica exists in large quantities in the upper valley above Mad river. Gold has been found in various tributaries, and at present a mine is being worked at Louis creek, about 30 miles from Kamloops, which, if it turns out well, will be a big asset to the surrounding country. Water-power may be developed on the river

itself at Hells Gate, 160 miles up. A head of 30 feet may be obtained, and a minimum flow of 300 to 500 second-feet. Of the tributaries, the Barrier river, at the 35-mile post, is the most important. A plant is now being installed whereby the city of Kamloops will obtain its light and power from the Barrier. Good industrial powers of 1,000 to 2,000 horse-power, may be located on the following streams: Mad river, at the 97-mile post; Tum Tum creek, at the 112-mile post; Salmon or Porcupine creek, at the 136-mile post; Hell Roaring creek, at the 152-mile post; Pyramid creek, at the 162-mile post, Clearwater river 70 miles from Kamloops.

From Tête Jaune Cache to Kamloops by the river is about 250 miles, but by the C.N.R. it is less than 190. (All mile-posts are located by the C.N.R.) From Kamloops to Mad River, at the 97-mile post the valley varies from half a mile to 1 mile in width. The soil is a sandy loam, and first-class land for fruit and mixed farming. Above Mad River the valley becomes much narrower, and there are only about 16,000 acres of arable land. Irrigation is required up to the 100-mile post, the precipitation varying from 7 inches at Kamloops to 40 inches at the Albreda Summit. Practically all the land has been taken up in the valley. There is very little large timber in the valley, except near the source, where several limits are held.

The streams and rivers above the 97-mile post are devoid of fish, said to be due to the large amount of mica in the waters, and apart from a few bears, there is no game to speak of in the valley.

The gauging station on the North Thompson river is 18 miles from the mouth. Here the river is 500 feet wide, and the depth varies from 6 feet to 25 feet, The rise and fall of the river at this point is about 15 feet. The maximum discharge in 1912 was 50,000 second-feet in May. The minimum flow was 2,050 second-feet in March. Maximum for 1913 was 65,000 in June, minimum 33,000 in April.

The North Thompson river is navigable during the summer from Kamloops to the 92-mile post, from the 112-mile post to 125-mile post, and from 137 to 172 mile.

(2) As before stated, the North and South Thompson meet at Kamloops. Strictly speaking, the Thompson river rises in the Shuswap lakes, and is only a flowing stream between Chase and Kamloops, a distance of 40 miles. And it is a very slow flowing stream. The drop between the Shuswap lakes and Kamloops being only 15 feet. The valley between Kamloops and Chase is from 1 mile to 3 miles wide, and is very suitable for mixed farming and fruit growing.

The drainage is 400 square miles, and a large percentage of this land may be cultivated or used for grazing purposes. The one great drawback is the lack of water for irrigation.

The remaining 7,000 square miles of the South Thompson drainage are drained by the Shuswap lakes. The chief feeders of this body of water are the Adams river, Anstey river, Seymour river, Eagle river, Shuswap river, and Salmon river. The precipitation throughout the drainage of these streams averages about 30 inches, the Salmon river being the only one in the dry belt. The Adams river is an ideal power stream, and also drains a fertile and well-timbered country. The Shuswap river has two good power sites on it, one below Sugar lake and the other below Mabel lake. Immense timber limits are held around Mabel and Sugar lakes. The Shuswap river drains the famous Okanagan valley from Armstrong north. The Salmon river drains the Grand Prairie district so well known as a mixed farming and ranching country. For further information on these streams see the individual gazetteers and reports.

The gauging station on this river was installed at Chase, B.C., in 1911. The width of the stream at the section is 400 feet, the depth from 15 feet to 25 feet

The maximum flow during the two years was 36,000 c. f. s., and took place on March 1, 1912. The rise and fall of the river at this section is 10 feet.

The South Thompson is navigable during the summer. Steamers ply between Chase, Sicamous, Salmon Arm, Anstey Arm, and Seymour Arm.

(3) From Kamloops the river flows into Kamloops lake, which is about 20 miles long and from 1 mile to 2 miles wide. As the river leaves the lake the fall becomes greater, and in the 20 miles to Ashcroft there is a drop of 200 feet. After leaving Ashcroft the river flows through the Black canyon. Between Ashcroft and Spences Bridge the river is very swift, and in the 25 miles there is a fall of 225 feet. Between Spences Bridge and Lytton the river is in a canyon practically all the way (30 miles). The fall in this distance is 317 feet. At Lytton the Thompson river discharges into the Fraser river. The Canadian Pacific Railway follows the left bank of the river from Kamloops, also from Chase to Lytton. The Canadian Northern Railway comes down the North Thompson and then follows the right bank practically all the way to Lytton. This eliminates any power possibilities.

There are good bench lands on both sides of the Thompson between Kamloops and Spences Bridge. The Ashcroft district is famous for its potatoes. The other benches are practically the same soil, and equally as valuable. Lack of water is the great difficulty in cultivation all through this district. The precipitation is very small, not exceeding 10 inches.

The three largest tributaries of the Thompson river below Kamloops, are the Deadman, entering from the right, below Savona lake, the Bonaparte entering from the right at Ashcroft, and the Nicola entering from the left at Spences Bridge, all drain rich agricultural districts and ranching countries. Practically the whole drainage below Kamloops and above Spences Bridge consists of a rolling-hill country unexcelled for ranching, and rich agriculturally where water can be obtained.

There is gold in the Thompson river, iron is prevalent in the Kamloops district, and three coal mines are working at Merritt in the Nicola valley.

The gauging station was established at Spences Bridge in October 1911, and continuous daily readings have been taken since. The river at this section is 400 feet wide and from 8 feet to 20 feet deep. The water is very swift, and never freezes in the winter. The maximum flow in 1912 was 90,000 c. f. s., and the minimum was 5,000 c. f. s.

The Thompson river drains the most settled part of the interior of British Columbia, with the exception of the lower Okanagan valley. The climate generally might be described as hot and dry in the summer, a cold short winter, with little snow. The country is well supplied with game, and fishing is good in both large and small streams and lakes.

Monthly Discharge of Thompson River at Spences Bridge for 1913.

(Drainage area, 21,000 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
January	6,620	5,075	5,730	0·27	0·31	352,320
February	5,870	5,000	5,454	0·26	0·27	302,900
March	5,330	4,925	5,152	0·25	0·29	316,800
April	23,200	5,240	11,749	0·56	0·62	699,100
May	73,600	23,200	42,460	2·02	2·33	2,610,700
June	110,420	78,000	95,976	4·57	5·10	5,711,000
July	86,800	52,070	64,703	3·08	3·56	3,978,000
August	50,000	35,400	42,270	2·01	2·32	2,599,000
September	34,800	22,740	29,205	1·39	1·55	1,737,500
October	22,280	14,820	17,013	0·81	0·93	1,045,900
November	14,400	9,950	11,811	0·56	0·62	702,600
December	9,390	5,750	4,355	0·21	0·23	267,780
Year	110,420	4,925	27,990	15·99	18·13	20,323,600

Discharge Measurements of Thompson River at Spences Bridge, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
May 8	K. G. Chisholm & C. G. Cline.	1,044	400	4,351	5·42	7·1	23,593
June 16	K. G. Chisholm	1,055	511	8,989	10·67	17·7	95,674
June 18	K. G. Chisholm & C. G. Cline.	1,044	503	9,229	10·83	18·15	99,970
Aug. 12	K. G. Chisholm	1,055	446	5,735	7·45	11·4	42,739

DAILY GAUGE HEIGHTS AND DISCHARGES of Thompson River at Spences Bridge for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	2·4	6,620	1·9	5,870	1·3	5,420	1·3	5,240	6·8	22,280	15·5	78,000
2	2·4	6,620	1·6	5,530	1·4	5,330	1·4	5,330	6·9	22,740	16·0	82,400
3	2·3	6,450	1·4	5,330	1·4	5,330	1·4	5,330	7·0	23,200	16·6	87,680
4	2·3	6,450	1·4	5,350	1·4	5,330	1·4	5,330	7·0	23,200	17·2	92,980
5	2·2	6,290	1·3	5,240	1·4	5,330	1·4	5,330	7·0	23,200	17·4	94,800
6	2·0	6,000	1·0	5,000	1·3	5,240	1·5	5,425	7·0	23,200	17·6	96,620
7	2·0	6,000	1·3	5,000	1·4	5,330	1·5	5,425	7·0	23,200	17·8	98,480
8	1·8	5,750	1·6	5,530	1·4	5,330	1·5	5,425	7·1	23,660	17·8	98,460
9	1·6	5·550	1·7	5,640	1·3	5,240	1·6	5,530	7·5	25,500	17·8	98,460
10	1·4	5,330	1·8	5,750	1·4	5,330	1·6	5,530	8·0	27,800	18·1	101,220
11	1·1	5,075	1·7	5,640	1·4	5,330	1·6	5,530	8·4	29,800	18·6	105,820
12	1·4	5,330	1·7	5,640	1·3	5,240	1·7	5,840	8·7	31,300	18·9	110,420
13	1·4	5,330	1·6	5,530	1·3	5,240	1·9	5,670	9·1	33,320	19·1	110,420
14	1·6	5,330	1·5	5,425	1·3	5,240	2·1	6,140	9·5	35,400	19·0	109,500
15	1·6	5,330	1·4	5,330	1·2	5,155	2·6	7,000	9·7	36,440	18·8	107,660
16	1·5	5,425	1·6	5,530	1·0	5,000	3·1	8,270	10·0	38,000	18·7	106,740
17	1·5	5,423	1·5	5,425	0·9	4,925	3·3	8,850	10·4	40,220	18·4	103,980
18	1·4	5,330	1·5	5,425	0·9	4,925	3·5	9,390	10·7	41,900	18·0	100,300
19	1·6	5,530	1·5	5,425	0·9	4,925	4·0	10,850	11·1	44,200	17·5	95,710
20	1·6	5,530	1·5	5,425	0·9	4,925	4·8	13,650	11·1	44,200	17·3	93,890
21	1·7	5,640	1·6	5,530	1·0	5,000	3·7	17,340	11·8	48,670	17·1	92,080
22	1·9	5,870	1·7	5,640	1·0	5,000	6·1	19,060	12·7	55,000	17·1	92,080
23	1·8	5,750	1·6	5,530	0·9	4,925	6·4	20,440	13·5	61,170	17·1	92,080
24	1·7	5,640	1·5	5,425	0·9	4,925	6·8	22,280	13·7	62,770	17·1	92,080
25	1·6	5,530	1·5	5,425	1·0	5,000	7·0	23,200	13·9	64,420	17·0	91,200
26	1·6	5,530	1·4	5,330	1·1	5,075	7·0	23,200	14·1	66,080	16·9	90,320
27	1·6	5,530	1·4	5,330	1·2	5,155	7·0	23,200	14·2	66,910	16·9	90,320
28	1·7	5,640	1·3	5,240	1·2	5,155	7·0	23,200	14·2	66,910	16·9	90,320
29	1·7	5,640	....	....	1·2	5,155	6·9	22,740	14·3	67,740	16·8	89,440
30	1·8	5,750	....	....	1·2	5,155	....	....	14·8	70,240	16·6	87,050
31	1·8	5,750	....	....	1·3	5,240	....	....	15·0	73,600	....	....

Daily Gauge Heights and Discharges of Thompson River at Spences Bridge for 1913—*Continued.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet	Sec.-ft.	Feet.	Sec.-ft
1	15·5	86,800	12·0	50,000	9·4	34,800	5·8	22,280	5·0	14,400	3·5	9,390
2	16·4	85,920	11·7	48,020	9·3	34,360	6·6	21,360	4·9	14,020	3·5	9,390
3	16·4	85,920	11·5	46,740	9·1	35,520	6·4	20,440	4·8	16,650	3·5	9,390
4	16·0	82,400	11·4	46,100	9·0	32,800	6·4	20,440	4·7	13,280	3·5	9,390
5	15·6	78,880	11·4	46,100	8·9	32,300	6·4	20,440	4·7	13,280	3·4	9,110
6	15·4	77,120	11·4	46,100	9·0	32,800	6·3	19,980	4·6	12,910	3·4	9,110
7	15·0	73,600	11·6	47,380	9·3	34,360	6·1	19,080	4·6	12,910	3·3	8,830
8	14·6	70,240	11·6	47,360	9·1	32,520	5·9	18,180	4·6	12,910	3·2	8,550
9	14·3	67,740	11·6	47,340	9·1	33,520	5·7	12,340	4·5	12,910	3·3	8,830
10	14·2	66,910	11·6	46,380	9·0	32,800	5·5	16,500	4·6	12,910	3·2	8,550
11	14·1	66,080	11·5	46,740	8·9	32,300	5·4	16,080	4·5	12,550	3·1	8,270
12	14·0	65,250	11·3	45,480	6·7	31,300	5·4	16,080	4·4	12,200	3·0	8,000
13	13·9	64,420	11·3	45,460	8,5	30,300	5·4	16,080	4·3	11,860	2·9	7,740
14	13·8	65,595	11·2	44,820	8·3	29,300	5·4	16,080	4·2	11,520	2·8	7,430
15	13·6	61,970	11·1	44,200	8·2	28,800	5·4	16,080	4·1	11,800	2·7	7,240
16	13·5	61,170	10·9	43,020	8·2	28,800	5·4	16,080	4·1	11,800	2·65	7,120
17	13·3	59,570	10·6	41,340	8·1	28,300	5·4	16,080	4·2	11,520	2·6	7,000
18	13·0	57,250	10·6	41,340	8·0	27,800	5·4	16,080	4·4	12,200	2·6	7,000
19	12·8	55,750	10·5	40,780	8·0	27,800	5·4	16,080	4·2	11,520	2·6	7,000
20	12·5	53,520	10·2	32,100	7·9	27,340	5·4	16,980	4·1	11,180	2·55	6,900
21	12·7	55,000	10·1	38,540	6·0	27,600	5·4	16,080	3·9	10,530	2·5	6,800
22	12·8	55,750	9·9	37,480	7·8	26,800	5·4	16,080	3·8	10,230	2·7	7,240
23	13·0	57,250	9·9	37,480	7·7	26,420	5·3	15,660	3·8	10,230	2·6	7,000
24	13·2	58,770	9·8	36,960	7·6	25,960	5·2	15,240	3·9	10,530	2·5	6,800
25	13·1	58,000	9·7	36,440	7·5	25,500	5·2	15,240	4·1	11,180	2·4	6,520
26	13·2	58,770	9·7	36,440	7·3	24,580	5·2	15,240	4·1	11,180	2·3	6,450
27	13·3	59,570	9·8	36,900	7·2	24,120	5·3	15,660	3·8	10,230	2·2	6,290
28	13·0	57,250	9·9	37,430	7·0	25,200	5·3	15,660	3·8	10,230	2·0	6,000
29	12·8	55,750	9·7	36,440	6·5	22,740	5·5	15,660	3·7	9·950	1·8	5,750
30	12·5	53,520	9·6	35,920	6·9	22,740	5·2	15,240	3·7	9,950	1·8	5,750
31	12·3	52,070	9·5	35,400	....	....	5·1	14,820	....	....	2·0	6,000

THOMPSON RIVER AT KAMLOOPS.

Location.—Section 6, township 17, range 20, west 6th meridian, just below confluence of the North and South Thompson rivers.

Records Available.—April 1 to September 30, 1911; March 24 to December 31, 1912; April 1 to December 31, 1912.

Winter Conditions.—River generally freezes over completely about 1st of January and remains so until early in March. During 1913-14 the river remained practically open throughout the winter. On March 5, 1912, a metering under ice cover showed a discharge of 3,980 second-feet. This represents the normal run-off during winter months.

Gauge.—A vertical staff gauge read daily by George Clapperton.

Channel.—The width of the channel varies from 100 to 800 feet, while at high water the depth is from 12 to 17 feet greater than at low stages.

Discharge Measurements.—The flow is well defined for a range of discharges from 4,000 to 90,000 second-feet. The stream, as a rule, reaches a maximum of over 100,000 second-feet. The peak of the flood flow is usually about the 20th of June, though this may vary a couple of weeks owing to climatic conditions.

Accuracy.—The accuracy on the whole is of a high degree, and except for the short period during which the flow is greater than 90,000 second-feet, the results as attached are considered to be within 5 per cent of actual conditions.

THOMPSON RIVER AT KAMLOOPS.

The Thompson river has its source at the junction of the North and South Thompson rivers at Kamloops, at an elevation of 1,130 feet and discharges into the Fraser river at Lytton at an elevation of 464 feet high water or 417 feet low water.

The drainage area above Kamloops is 14,400 square miles.

The gauge used is the British Columbia Meteorological Service gauge at the lower traffic bridge at Kamloops, and daily readings have been taken by this survey continuously since September 8, 1911.

Readings are available for this gauge since the summer of 1910, but owing to two changes of datum of uncertain amount, it was not considered advisable to make use of readings except those taken by this survey.

The river rises from the end of March to the middle of June, from 12 to 17 feet, receding slowly until December 1, when freeze-up generally takes place and remains fairly constant till the break-up in March. At low water the mean velocity is about 0·5 feet per second, at high water about 5 feet per second.

Discharge Measurements of Thompson River at Kamloops 1911-12, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
1911.							
Sept. 8	C. E. Richardson	1,048	7·15	11,600	1·90	4·37	22,000
Oct. 3	"	1,048	7·06	10,100	1·36	2·50	13,700
Dec. 1	"	1,048	6·95	8,650	0·83	0·50	7,180
1912.							
Mar. 5	"	1,057	6·85	8,030	0·50	....	3,980[1]
Apr. 8	"	1,057	6·90	8,037	0·51	−0·20	4,090
July 9	"	1,048	7·68	14,300	3·33	8·50	47,700
July 22	"	1,048	7·68	13,100	2·74	7·07	35,900
Aug. 23	"	1,048	7·65	12,300	2·70	6·20	33,400
1913.							
June 6	H. J. Keys	1,057	7·83	17,540	4·95	13·1	86,890

Note.—[1]Ice cover.

MONTHLY DISCHARGE of Thompson River at Kamloops, for 1913.

(Drainage area, 14,400 square miles.)

Month.	Discharge in Second-Feet. Maximum.	Minimum.	Mean.	Per square mile.	Run-Off. Depth in inches on Drainage area.	Total in acre-feet.
April	16,600	1,900	9,370	0·65	0·72	557,500
May	66,800	15,800	31,265	2·17	2·50	1,924,600
June	100,500	70,200	85,000	5·90	6·58	5,057,800
July	74,500	41,300	54,342	3·77	4·35	3,338,800
August	40,600	27,900	33,968	2·36	2·73	2,090,600
September	29,600	17,100	22,400	1·55	1·73	1,332,900
October	17,500	11,800	13,742	0·96	1·11	842,400
November	12,200	8,100	9,827	0·68	0·76	584,900
December	8,700	5,500	6,974	0·48	0·55	428,570
The period	100,500	1,900	29,654	2·06	21·03	16,158,070

NOTE.—Accuracy "A".

DAILY GAUGE HEIGHTS AND DISCHARGES of Thompson River at Kamloops for 1913.

Day.	April. Gauge Height.	April. Dis-charge.	May. Gauge Height.	May. Dis-charge.	June. Gauge Height.	June. Dis-charge.
1	−1·5	1,900	3·1	16,200	11·2	70,200
2	−1·4	2,000	3·1	16,200	11·6	73,600
3	−1·0	2,500	3·1	16,200	12·1	77,900
4	−1·0	2,500	3·1	16,200	12·4	80,500
5	−0·9	2,700	3·0	15,800	12·7	83,200
6	−0·8	2,900	3·0	15,800	13·0	85,900
7	−0·7	3,100	3·0	15,800	13·0	85,900
8	−0·3	4,100	3·1	16,200	12·8	84,100
9	0·2	5,500	3·3	17,100	13·3	88,600
10	0·2	5,500	3·6	18,400	13·7	92,200
11	0·2	5,500	4·3	21,600	14·1	96,000
12	0·2	5,500	5·0	25,200	14·5	99,600
13	0·2	5,500	5·5	27,900	14·5	99,600
14	0·5	6,400	5·6	28,500	14·5	99,600
15	0,9	7,800	5·7	29,000	14·6	100,500
16	1·4	8,500	5·7	29,000	14·2	96,900
17	1·6	10,200	5·7	29,000	13·6	91,300
18	1·9	11,400	5·8	29,600	13·2	87,700
19	2·1	12,200	5·8	29,600	12·6	82,300
20	2·5	13,700	6·0	30,800	12·2	78,700
21	2·8	14,900	6·3	32,600	12·6	82,300
22	3·1	16,200	6·7	35,000	12·8	84,100
23	3·2	16,600	6·9	36,400	12·5	82,300
24	3·2	16,600	7·2	38,500	12·5	81,400
25	3·1	16,200	7·8	42,700	12·2	78,700
26	3·0	15,800	8·3	46,300	12·2	78,700
27	3·0	15,800	8·8	50,200	12·3	79,600
28	3·1	16,200	9·4	55,000	12·1	77,900
29	3·1	16,200	9·8	58,200	11·9	76,200
30	3·1	16,200	10·4	63,400	11·7	74,500
31	....	....	10·8	66,800	....	....

DAILY GAUGE HEIGHTS AND DISCHARGES of Thompson River at Kamloops for 1913—*Continued.*

Day	July.		August		September.		October		November.		December.	
	Gauge Height	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	11·7	74,500	7·2	38,500	5·5	27,900	3·4	17·500	2·1	12,200	1·0	8,100
2	11·7	74,500	7·0	37,100	5·2	26·300	3·2	16,600	2·0	11,800	1·2	8,700
3	11·6	73,600	7·3	39,200	5·0	25,200	3·2	16,600	2·1	12,200	1·2	8,700
4	11·2	70,200	7·4	39,900	4·9	24,600	3·1	16,200	2·0	11,800	1·2	8,700
5	10·8	66,800	7·3	39,200	4·8	24,100	3·0	15,800	2·0	11,800	1·0	8,100
6	10·3	62,500	7·5	40,600	4·7	23,600	2·8	14,900	1·8	11,000	1·1	8,400
7	10·0	60,000	7·3	39,200	5·8	29,600	2·6	14,100	1·8	11,000	1·1	8,400
8	9·8	58,200	7·2	38,500	5·2	26,300	2·6	14,100	1·7	10,600	1·0	8,100
9	9·9	59,100	7·2	38,500	4·2	21,200	2·4	13,300	1·8	11,000	1·0	8,100
10	9·5	55,800	7·0	37·100	4·5	22,600	2·2	12,500	1·5	9,900	0·8	7,400
11	9·4	55,000	7·0	37,100	4·9	24,600	2·2	12,500	1·5	9,900	0·7	7,000
12	9·5	55,800	6·7	35,000	4·7	23,600	2·1	12,200	1·8	11,000	0·7	7,000
13	9·3	54,200	7·0	37,100	4·6	23,100	2·0	11,800	1·5	9,900	0·7	7,000
14	9·0	51,700	7·0	37,100	4·5	22,600	2·3	12,900	1·3	9,100	0·7	7,000
15	8·9	50,900	6·8	35,700	4·7	23,600	2·3	12,900	1·5	9,900	0·7	7,000
16	8·8	50,200	6·5	33,700	4·6	23,100	3·0	15,800	1·3	9,100	0·7	7,000
17	8·5	47,900	6·3	32,600	4·4	22,100	2·7	14,500	1·2	8,700	0·7	7,000
18	8·4	47,100	6·0	30,800	4·2	21,200	2·8	14,900	1·5	9,900	0·7	7,000
19	8·2	45,600	6·0	30,800	4·4	22,100	2·5	13,700	1·4	9,500	0·6	6,700
20	8·3	46,300	6·0	30,800	4·5	22,600	2·3	12,900	1·2	8,700	0·6	6,700
21	8·4	47,100	6·0	30,800	4·2	21,200	2·2	12,500	1·2	8,700	0·5	6,400
22	8·7	49,400	5·8	29,600	4·1	20,800	2·5	13,700	1·2	8,700	0·5	6,400
23	8·8	50,200	5·7	29,000	4·0	20,300	2·2	12,500	1·2	8,700	0·5	6,400
24	8·9	50,900	5·7	29,000	3·8	19,400	2·2	12,500	1·2	8,700	0·4	6,100
25	8·9	50,900	5·8	29,600	4·1	20,800	2·3	12,900	1·2	8,700	0·3	5,800
26	8·8	50,200	6·0	30,800	3·8	19,400	2·1	12,200	1·2	8,700	0·2	5,500
27	8·7	49,400	5·9	30,200	3·6	18,400	2·5	13,700	1·2	8,700	0·2	5,500
28	8·4	47,100	5·8	29,600	3·3	17,100	2·3	12,900	1·1	8,400	0·2	5,500
29	8·0	44,100	5·7	29,000	3·3	17,100	2·3	12,900	1·1	8,400	0·2	5,500
30	8·0	44,100	5·5	27,900	3·4	17,500	2·3	12,900	1·0	8,100	0·2	5,500
31	7·6	41,300	5·7	29,000	....	....	2·2	12,500	....	....	0·2	5,500

NORTH THOMPSON RIVER.

Location.—Section 23, township 22, range 17, west 6th meridian., above the "Hefferly riffle."

Records Available.—April 1, 1912, to December 20, 1912; April 13, 1913, to December 31, 1913.

Winter Conditions.—Stream is usually under ice cover from January 1 to April 1. Meterings made of the flow under ice cover showed on Febuary 9, 1912, a discharge of 2,120 second-feet, and on March 12 a discharge of 1,560 second-feet.

Gauge.—A chain gauge is used and daily readings are made by E. Sutton.

Channel.—The channel is about 400 feet wide, and the water is 10 to 15 feet deeper at high than at low stages, mean velocities varying from 0.3 to 5.3 feet per second.

Discharge Measurements.—The flow is well defined by seven well-distributed meter measurements. Considerable difficulty is encountered, however, in securing meterings of maximum flow.

Accuracy.—The accuracy, on the whole, is fairly high (within 10 per cent).

NORTH THOMPSON RIVER.

For general description of North Thompson river see Thompson river at Spences Bridge.

Discharge Measurements of North Thompson River near Black Pines P. O. 1912 and 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1912.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Feb. 9	C. G. Cline	1046	380	4,230	0·5	10·0	2,120*
Mar. 12	C. Richardson	1047	380	4,020	0·39	....	1,560
April 19	C. G. Cline	1046	380	5,240	1·36	11·6	7,150
June 5	Keys & Dann	1044	400	7,775	3·73	16·8	29,025
April 12	Keys and Cline	1057	390	4,750	0·7	10·3	3,330
1913.							
June 5	Keys and Chisholm	1057	410	11,980	5·2	24·8	62,620
July 22	H. J. E. Keys	1057	420	7,440	4·5	20·2	34,100

* Ice conditions.

Monthly Discharge of North Thompson River near Cooney's Ranch for 1913.

(Drainage area, 7,000 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
April	15,060	3,300	7,983	1·14	1·27	474,800
May	55,680	9,950	24,929	3,56	4·10	1,531,000
June	65,360	49,960	57,634	8·23	9·18	3,427,400
July	52,940	33,990	41,874	5,98	6,89	2,576,300
August	41,160	30,980	35,821	5·12	5·90	2,201,300
September	36,040	21,700	26,860	3·84	4·28	1,600,700
October	22,900	15,820	18,766	2,68	3,09	1,156,000
November	16,580	13,160	14,110	2·01	2·24	839,000
December	13,160	9,250	11,367	1·62	1·86	701,000
The period	65,360	3,300	26,594	3·80	38·81	14,507,500

Daily Gauge Heights and Discharges of North Thompson River 1 mile above Jamieson Creek for 1913.

Day.	April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	3,300	12·6	11,000	23·7	57,880
2	....	3,300	12·4	10,300	24·2	60,080
3	....	3,300	12·3	9,950	24·4	60,960
4	....	3,300	12·4	10,300	24·7	62,380
5	....	3,300	12·4	10,300	24·5	61,500
6	....	3,400	12·4	10,300	24·4	60,960
7	....	3,400	12·4	10,300	24·4	60,960
8	....	3,400	12·4	10,300	24·1	59,640
9	....	3,400	12·7	11·350	24·6	61,940
10	....	3,400	13·5	14,300	24·9	63,260
11	....	3,500	14·9	19,620	25·2	64,480
12	10·3	3,540	15·6	22,500	25·4	65,360
13	10·6	4,380	5·7	22,900	25·1	64,040
14	11·1	5,840	16·0	24,100	24·8	62,820
15	11·5	7,200	16·0	24,100	24·6	61,940
16	11·7	7,880	15·8	23,300	24·0	59,200
17	12·0	8,900	15·9	23,700	23·4	56,560
18	12·2	9,600	15·7	22,900	22·3	51,720
19	12·6	11,000	15·8	23,300	22·0	50,400
20	13·2	13,160	16·1	24,530	21·9	49,960
21	13·2	13,160	16·5	26,250	22·8	58,820
22	13·7	15,060	16·8	27,540	23·2	55,680
23	13·6	14,680	17·2	29,260	22·8	53,820
24	13·5	14,300	17·8	31,840	22·5	52,600
25	13·2	13,160	18·5	34,750	22·6	52,940
26	13·1	12,780	19·1	37,640	22·8	53,820
27	13·0	12,400	19·9	41,160	22·7	53,380
28	13·0	12,400	21·0	46,000	22·5	52,600
29	12·8	11,700	21·8	49·520	22·4	52,160
30	12·7	11,350	22·8	53,820	22·4	52,160
31	....	....	23·2	55,680	....	....

Daily Gauge Heights and Discharges of North Thompson River 1 mile above Jamieson Creek for 1913.—*Continued.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	22·4	52,160	18·2	33,560	17·8	31,840	15·4	21,700	14·1	16,580	13·2	13,160
2	22·6	52,940	18·1	33,130	17·3	29,690	15·2	20,900	14·0	16,200	13·2	13,160
3	21·8	49,520	18·7	35·610	17·0	28·400	15·1	20,500	13·9	15·820	13·1	12,780
4	21·4	47,760	19·1	37,640	17·2	29,260	15·0	20,100	13·8	15,440	13·1	12,780
5	21·0	46,000	19·2	38,080	17·6	30,980	14·9	19,620	13·8	15,440	13·0	12,400
6	20·4	43,360	19·4	38·960	18·8	36,040	14·7	18,860	13·6	14·680	13·0	12,400
7	19·9	41,160	19·7	40,280	17·6	30,980	14·5	18,100	13·6	14,680	12·9	12,050
8	20·8	45,120	19·8	40,720	17·4	30,120	14·4	17,720	13·6	14,680	12·9	12,050
9	20·9	45,560	19·9	41,160	17·0	28,400	14·3	17,340	13·5	14,300	13·0	12,400
10	19·9	41,160	19·6	39,840	16·8	27,540	14·2	16,960	13·5	14,300	12·9	12,050
11	20·0	41,600	19·3	38,520	16·7	27,110	14·1	16,580	13·5	14,300	12·9	12,050
12	20·4	43,360	19·4	38,960	16·6	26,680	14·0	16,200	13·5	14,300	12·9	12,050
13	19·8	40,720	19·5	39,400	16·5	26,250	13·9	15,820	13·4	13,920	12·8	11,700
14	19·7	40,280	19·7	40,280	16·6	26,680	14·9	19,620	13·4	13,920	....	11,700
15	19·4	38,960	19·4	38,960	16·5	26,250	15·7	22,900	13·4	13,920	....	11,700
16	19·5	39,400	19·1	37,640	16·4	25,820	15·3	21,300	13·4	13,920	....	11,700
17	18·9	36,470	18·6	35,180	16·3	25,390	15·6	22,500	13·3	13,540	....	11,700
18	18·6	35,180	18·2	33,560	16·3	25,390	15·5	22,100	13·3	13,540	....	11,700
19	18·7	35,610	18·2	33,560	16·7	27,110	14·6	18,480	13·3	13,540	....	11,700
20	18·8	36,040	18·1	33,130	16·8	27,540	14·5	18,100	13·3	13,540	....	11,700
21	19·2	38,080	18·0	32,700	16·7	27,110	14·5	18,100	13·2	13,160	12·8	11,700
22	19·8	40,720	17·8	31,840	16·6	26,680	14·5	18,100	13·2	13,160	12·6	11,000
23	20·4	43,360	17·6	30,980	16·4	25,820	14·5	18,100	13·2	13,160	12·4	10,300
24	20·5	43,800	18·1	33,130	16·1	24,530	14·5	18,100	13·2	13,160	12·3	9,950
25	20·9	45,560	18·2	33,560	15·8	23,300	14·5	18,100	13·2	13,160	12·1	9,250
26	20·6	44,240	18·3	33,990	15·7	22,900	14·5	18,100	13·3	13,540	12·1	9,250
27	19·9	41,160	18·2	33,560	15·5	22,100	14·5	18,100	13·3	13,540	12·2	9,600
28	19·6	39,840	18·2	33,560	15·4	21,700	14·4	17,720	13·3	13,540	12·3	9,950
29	19·3	38,520	18·0	32,700	15·4	21,700	14·4	17,720	13·2	13,160	12·2	9,600
30	18·9	36,470	18·2	33,560	15·6	22,500	14·3	17·340	13·2	13·160	12·2	9,600
31	18·3	33,990	....	32,700	....	....	14·2	16,960	....	....	12·1	9,250

THOMPSON RIVER NEAR CHASE.

Location.—The station is located in township 21, range 13, west 6th meridian, just below Little Shuswap lake, 1 mile from Chase, at the Adams River Lumber Company's wharf.

Records Available.—May to July, 1911; April to December, 1912; April to December, 1913.

Winter Conditions.—The winter conditions in this district are fairly severe, the thermometer going as low as (-20 °F.). The snowfall is about 6 feet. The river generally freezes over or is affected by ice conditions for two or three months each winter.

Gauge.—A vertical staff gauge is used and read by Mr. F. Cook of the Adams River Lumber Company, Chase, B. C.

Channel.—Immediately above the section the river broadens out into Little Shuswap lake. Below the section the river is straight for 200 yards where there is a slight riffle in low water. The river is navigable.

Discharge Measurements.—Eleven well distributed measurements have been made in 1911-12-13. Measurements are made from temporarily established cable and boat.

Accuracy.—Accurate gauge readings are obtained, conditions for metering are favourable; these results should be within 10 per cent.

Discharge Measurements of Thompson River near Chase 1911-12-13.

Date.	Hydrographer.	Meter No.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec. ft.
1911.							
Oct. 20	C. E. R.	1048	415	4,450	1·30	0·8½	5,780
1912.							
Mar. 1	"	1047	325	3,710	0·68	0·10	2,384
May 18	"	1047	465	6,480	5·53	5·5	19,600
June 13	"	1048	485	7,190	4·24	7·2	30,800
June 21	"	1047	495	7,600	4·46	8·0	33,800
July 24	"	1047	460	6,200	5·18	5·0	19,600
Sept. 5	"	1049	445	5,180	2·25	2·98	11,600
1913.							
May 12	C. E. R. & J. A. E.	1048	460	5,780	2·26	3·5	13,100
June 10	H. J. E. K.	1057	500	8,390	4,50	9·52	38,100
July 7	"	1057	500	7,850	4·10	8·0	32,400
Oct. 22	K. G. C.	1055	420	4,378	1·51	1·7½	6,627

Monthly Discharge of South Thompson River near Chase for 1913.

(Drainage area, 7,000 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
April	9,970	2,800	5,330	0·76	0·85	317,000
May	26,000	10,200	15,119	2·16	2·49	928,000
June	48,300	27,000	41,740	5·96	6·65	2,480,000
July	39,200	22,100	28,987	4·14	4·77	1,780,000
August	21,200	13,000	15,319	2·19	2·52	941,000
September	12,600	9,660	11,364	1·62	1·81	676,000
October	9,360	6,970	7,660	1·09	1·26	471,000
November	6,970	5,850	6,314	0·90	1·00	376,000
December	6,060	4,140	5,170	0·74	0·85	318,000

Note.—First eleven days in April are estimated.

DAILY GAUGE HEIGHTS AND DISCHARGES of South Thompson River near Chase for 1913.

Day.	April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	....	2·8	10,200	6·8	27,000
2	....	....	2·9	10,500	7·1	28,500
3	....	....	2·9	10,500	7·5	30,600
4	....	....	2·9	10,500	7·9	32,600
5	....	....	3·0	10,800	8·3	34,700
6	....	....	3·0	10,800	8·3	35,800
7	....	....	3·0	10,800	8·6	36,400
8	....	....	3·0	10,800	8·9	38,000
9	....	....	3·0	10,800	9·2	39,800
10	....	....	3·1	11,100	9·5	41,500
11	....	....	3·3	11,900	9·8	43,200
12	0·0	3,800	3·6	13,000	10·0	44,400
13	0·1	3,970	3·8	13,700	10·3	46,300
14	0·2	4,140	3·9	14,000	10·5	47,600
15	0·3	4,320	4·0	14,400	10·6	48,300
16	0·6	4,860	4·0	14,400	10·6	48,300
17	0·8	5,240	4·1	14,800	10·6	48,300
18	0·8	5,240	4·2	15,200	10·5	47,600
19	1·0	5,640	4·3	15,600	10·5	47,600
20	1·1	5,850	4·4	16,000	10·4	47,000
21	1·4	6,500	4·4	16,000	10·4	47,000
22	1·5	6,730	4·6	16,800	10·3	46,300
23	1·7	7,220	4·8	16,800	10·2	45,700
24	1·8	7,470	4·8	17,600	10·0	44,400
25	1·9	7,720	5·0	18,400	10·0	44,400
26	2·2	8,510	5·1	18,900	9·9	43,800
27	2·3	8,790	5·4	20,200	9·8	43,200
28	2·4	9,070	5·6	21,200	9·7	42,600
29	2·5	9,360	6·0	23,000	9·5	41,500
30	2·7	9,970	6·2	24,000	9·2	39,800
31	....	....	6·6	26,000	....	....

DAILY GAUGE HEIGHTS AND DISCHARGES of South Thompson River near Chase for 1913.—*Continued.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	9·1	39,200	5·6	21,200	3·5	12,600	2·5	9,360	1·6	6,970	1·2	6,060
2	9·0	38,600	5·3	19,800	3·4	12,200	2·5	9,360	1·6	6,970	1·2	6,060
3	8·8	37,500	5·1	18,900	3·3	11,900	2·4	9,070	1·6	6,970	1·2	6,060
4	8·7	36,900	5·0	18,400	3·3	11,900	2·4	9,070	1·5	6,730	1·2	6,060
5	8·6	36,400	4·9	19,000	3·3	11,900	2·3	8,790	1·5	6,730	1·2	6,060
6	8·4	35,300	4·9	18,000	3·4	12,200	2·2	8,510	1·5	6,730	1·1	5,850
7	8·0	33,100	4·7	17,200	3·4	12,200	2·1	8,240	1·4	6,500	1·1	5,850
8	7·9	32,600	4·5	16,400	3·4	12,200	2·1	8,240	1·4	6,500	1·0	5,640
9	7·8	32,100	4·4	16,000	3·4	12,200	2·0	7,980	1·4	6,500	1·0	5,640
10	7·6	31,100	4·3	15,600	3·4	12,200	1·9	7,720	1·3	6,280	1·0	5,640
11	7·5	30,600	4·2	15,200	3·3	11,900	1·8	7,470	1·3	6,280	0·9	5,440
12	7·4	30,000	4·2	15,200	3·3	11,900	1·9	7,720	1·3	6,280	0·9	5,440
13	7·2	29,000	4·1	14,800	3·3	11,900	1·9	7,720	1·3	6,280	0·8	5,240
14	7·1	28,500	4·1	14,800	3·3	11,900	1·8	7,470	1·3	6,280	0·8	5,240
15	7·0	28,000	4·0	14,400	3·3	11,900	1·8	7,470	1·3	6,280	0·8	5,240
16	7·1	28,500	4·0	14,400	3·2	11,500	1·8	7,470	1·3	6,280	0·8	5,240
17	7·0	28,000	4·0	14,400	3·2	11,500	1·7	7,220	1·3	6,280	0·7	5,050
18	6·9	27,500	4·0	14,400	3·1	11,100	1·7	7,220	1·3	6,280	0·7	5,050
19	6·8	27,000	4·0	14,400	3·1	11,100	1·7	7,220	1·3	6,280	0·6	4,860
20	6·7	26,500	4·0	14,400	3·1	11,100	1·7	7,220	1·2	6,060	0·6	4,860
21	6·6	26,000	4·0	14,400	3·1	11,100	1·7	7,220	1·2	6,060	0·5	4,680
22	6·5	25,500	3·9	14,000	3·0	10,800	1·6	6,970	1·2	6,060	0·5	4,680
23	6·4	25,000	3·9	14,000	2·9	10,500	1·6	6,970	1·2	6,060	0·5	4,680
24	6·3	24,500	3·8	13,700	2·9	10,500	1·6	6,970	1·2	6,060	0·5	4,680
25	6·2	24,000	3·8	13,700	2·9	10,500	1·6	6,970	1·2	6,060	0·5	4,680
26	6·2	24,000	3·7	13,300	2·8	10,200	1·6	6,970	1·2	6,060	0·4	4,500
27	6·1	23,500	3·7	13,300	2·8	10,200	1·6	6,970	1·2	6,060	0·4	4,500
28	6·0	23,000	3·7	13,300	2·8	10,200	1·6	6,970	1·1	5,850	0·4	4,500
29	5·9	22,500	3·7	21,300	2·7	9,970	1·6	6,970	1·1	5,850	0·3	4,320
30	5·8	22,100	3·6	13,000	2·6	9,660	1·6	6,970	1·1	5,850	0·3	4,320
31	5·8	22,100	3·6	13,000	....	....	1·6	6,970	....	....	0·2	4,140

TRANQUILLE RIVER.

Location.—Section 36, township 20, range 19, west 6th meridian; a mile above Tranquille sanatorium.

Records Available.—July 4, 1911, to October 21, 1911; March 29, 1912, to September 7, 1912; May 1, 1913, to October 31, 1913.

Winter Conditions.—Climatic conditions practically the same as at Kamloops. Stream freezes over duringt he winter of 1911-12. A metering made under ice cover on Febuary 1, 1912, showed a discharge of 8.3 second-feet.

Gauge.—Standard vertical staff gauge read tri-weekly by Eugene Cooney.

Channel.—The channel is straight at the gauge section, the stream bed is composed of stones and boulders and the control is good.

Discharge Measurements.—The gauge-height-discharge curve is well defined for the stream's range.

Accuracy.—The accuracy of returns given is considered to be very high.

TRANQUILLE RIVER.

Tranquille river is about 30 miles long, varying in width from 15 to 50 feet, and in depth from 1 to 6 feet. It rises in township 25, range 19, west of 6th meridian, at an elevation of about 6,000 feet, and discharges into Kamloops lake, whose altitude is 1,125 feet. About 3 miles from the mouth, there is a

canyon 100 feet wide, with steep granite banks. Just above the canyon the right fork of Tranquille river enters. It rises in lake du Bois at an elevation of 2,600 feet. The middle fork joins the Tranquille about 4 miles above the head of the canyon, one branch of which is known as Watching creek, rises in Pass lake (3,300 feet). The main stream fed by the snow of the Sil-Whoia-Kun mountains (6,030 feet) comes from Tranquille lake (4,800 feet). These lakes are difficult of access, and no storage has as yet been possible, although if necessity arose it no doubt could be obtained. The drainage basin of the Tranquille river is sparsely timbered in the lower reaches, but well timbered in the upper part. There are two dams on Tranquille river, both of which have fallen into disuse. They were constructed several years ago by mining interests. The upper dam, on Watching creek, was 20 feet high.

The river station on Tranquille river was established on June 4, 1911, by C. G. Cline. The measuring section is located about 20 feet above Cooney's diversion dam, and 1½ miles above the mouth. This is an excellent section; the control is good, current uniform, banks high, and there is one permanent channel. The measurements are all made by wading. A standard vertical staff gauge is located 100 yards above the dam, and its datum is referred to three benchmarks.

Discharge Measurements of Tranquille River near Kamloops 1911-12-13.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1911.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
July 4	C. G. Cline	1,046	14	17·70	1·08	0·94	[1]19·10
Sept. 11	do	1,046	13	9·35	0·25	0·60	2·34
1912.							
Feb. 1	G. Stairs	1,053	12	15·35	0·54	....	[2]8·25
" 1	do	1,046	12	14·90	0·59	....	[2]8·75
April 13	E. M. Dann	1,046	11	15·20	1·17	0·96	17·80
May 17	do	....	34	59·20	7·70	2·50	[3]456·00
" 12	do	1,104	36	74·50	7·73	2·70	[3]575·60
" 25	do	1,104	34	52·00	6·04	2·10	[3]313·90
June 1	do	1,104	21	30·50	4·46	1·52	[3]135·96
Aug. 2	H. J. E. Keys	1,057	14	10·30	2·03	0·88	[3]20·90
Sept. 10	do	....	18	19·20	1·70	1·01	[4]33·20
1913.							
May 5	do	1,057	28	29·00	4·00	1·43	[5]115·00
" 30	do	1,057	18·5	45·80	5·20	2·02	237·00

Note.—[1] At Kamloops lake.
[2] At Cooney's Ranch (Ice conditions).
[3] Foot Bridge.
[4] Cooneys Ranch.
[5] Above Dam.

MONTHLY DISCHARGE of Tranquille River $1\frac{1}{2}$ miles from Mouth for 1913.

(Drainage area, 230 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May	614	117	288·8	1·26	1·45	17,700
June	208	48	96·5	0·42	0·47	5,740
July	153	24	67·1	0·29	0·33	4,130
August	24	7·5	14·5	0·06	0·07	892
September	10	4·1	5·8	0·02	0·02	345
October	14·9	4·1	10·4	0·04	0·05	640

DAILY GAUGE HEIGHTS AND DISCHARGES of Tranquille river $1\frac{1}{2}$ miles from Mouth for 1913.

Day.	May.		June.		July.		August.		September.		October.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	1·5	129	1·8	208	1·4	105	0·95	24	0·75	7·5	0·67	4·1
2	1·5	129	1·75	194	1·35	94	0·95	24	0·75	7·5	0·67	4·1
3	1·52	134	1·67	172	1·4	105	0·82	11·4	0·75	7·5	0·67	4·1
4	1·57	146	1·6	153	1·3	83	0·9	17	0·8	10·0	0·7	5·0
5	1·45	117	1·5	129	1·3	83	0·85	13·5	0·8	10·0	0·7	5·0
6	1·45	117	1·45	117	1·2	62	0·85	13·5	0·75	7·5	0·7	5·0
7	1·65	167	1·4	105	1·2	62	0·9	17	0·75	7·5	0·7	5·0
8	1·75	194	1·35	94	1·17	57	0·9	17	0·72	6·0	0·7	5·0
9	2·6	516	1·35	94	1·15	53	0·85	13·5	0·72	6·0	0·7	5·0
10	2·65	540	1·3	83	1·1	45	0·85	13·5	0·72	6·0	0·7	5·0
11	2·8	614	1·25	72	1·15	53	0·8	10	0·7	5·0	0·75	7·5
12	2·35	402	1·25	72	1·2	62	0·8	10	0·7	5·0	0·77	7·5
13	2·3	380	1·2	62	1·35	94	0·95	24	0·7	5·0	0·8	10
14	2·2	340	1·2	62	1·45	117	0·9	17	0·7	5·0	0·85	13·5
15	2·1	303	1·2	62	1·6	153	0·9	17	0·7	5·0	0·87	14·9
16	2·1	303	1·17	57	1·5	129	0·87	14·9	0·7	5·0	0·87	14·9
17	2·05	286	1·15	53	1·4	105	....	14·9	0·7	5·0	0·87	14·9
18	2·1	303	1·12	48	1·3	83	....	14·9	0·7	5·0	0·87	14·9
19	2·1	303	1·15	53	1·2	62	....	14·9	0·7	5·0	0·87	14·9
20	2·07	293	1·2	62	1·15	53	....	14·9	0·7	5·0	0·85	13·5
21	2·05	286	1·15	53	1·1	45	....	14·9	0·7	5·0	0·85	13·5
22	2·05	286	1·2	62	1·2	62	....	14·9	0·7	5·0	0·85	13·5
23	2·07	293	1·2	62	1·15	53	....	14·9	0·7	5·0	0·85	13·5
24	2·1	303	1·35	94	1·1	45	0·87	14·9	0·7	5·0	0·85	13·5
25	2·17	329	1·37	99	1·05	38	0·87	14·9	0·7	5·0	0·85	13·5
26	2·15	322	1·5	129	1·05	38	0·85	13·5	0·7	5·0		13·5
27	2·15	322	1·4	105	1·0	30	0·82	11·4	0·7	5·0	Est'd.	13·5
28	2·1	303	1·4	105	1·0	30	0·8	10	0·7	5·0	6 days	13·5
29	2·05	286	1·5	129	1·0	30	0·77	8·5	0·7	5·0	=0·85	13·5
30	2·0	268	1·4	105	0·97	26	0·75	7·5	0·67	4·1		13·5
31	1·9	238	....	....	0·95	24	0·75	7·5	....	....		13·5

MISCELLANEOUS METERING STATIONS.

LIST OF MISCELLANEOUS STREAM MEASUREMENTS in Kamloops division, British Columbia Hydrographic Survey, during 1913.

River or Stream.	Location.	Gauging.	Date.	Hydrographer.
Bear Creek	Near mouth	11·1	Nov. 11	K. G. Chisholm.
Campbell Creek	do	13·2	June 17	H. J. Keys.
Cache Creek	Above diversions	16·7	April 26	K. G. C. & C. G. C.
do	do	41·5	May 15	K. G. C.
do	do	12·2	June 9	do
do	do	6·4	July 3	do
Cornwall Creek	do	7·0	May 20	do
Cleme's Creek	Near mouth	7·1	April 23	do
do	do	21·2	May 18	do
Dairy Creek	Above diversion	2·0	June 14	H. J. E. Keys.
Duffy Creek	Near mouth	2·1	June 13	do
Eagle River	Sicamous	1,427·0	Oct. 24	E. M. D. & K. G. C.
Eight Mile Creek	Guichon Creek	15·5	May 22	H. J. E. Keys.
do	Drainage	1·0	Aug. 2	do
do	do	0·5	Aug. 16	do
Fortunes Creek	Below Power House	6·5	Oct. 28	K. G. C.
Fadear Creek	Near mouth	39·1	June 28	H. J. E. K.
Gordon Creek	Above diversions	3·1	April 16	do
Highfalls Creek	At mouth near Celeste	112·0	June 6	E. M. Dann.
Mission Creek	Near mouth	66·4	Nov. 11	E. M. D. & H. J. K.
Murray Creek	Above diversions	26·4	May 8	K. G. C.
do	do	8·0	Oct. 2	do
Maiden Creek	do	1·3	April 30	do
do	do	9·7	May 24	do
Nelson Creek	Above divers. from Barnes Lake.	1·2	May 2	do
do	do do	1·0	June 13	do
Oregon Jack Creek	(Basque Ranch)	4·8	May 21	do
do	Above Hammond's headgate	6·2	Aug. 2	do
Power Creek	At mouth	4·1	Nov. 10	E. M. D. & K. G. C.
Ross Creek	Mouth	372·0	June 7	E. M. Dann.
Ray Creek	Near mouth	15·0	May 22	H. J. E. Keys.
Scotch Creek	Mouth	2,422·0	June 8	E. M. Dann.
Shuswap River	Coteau Falls	1,087·0	Oct. 30	E. M. D. & K. G. C.
Seymour River	Mouth	4,272·0	June 5	E. M. Dann.
Three Mile Creek	Kamloops-Savona Rd	2·0	Sept. 3	H. J. E. K.
do	Savona-Merritt Rd	0·5	Sept. 2	H. J. E. K.
Tulameen Creek		857·0	Nov. 16	E. M. D. & K. G. C.
Twenty Mile Creek	Above diversions	13·2	Nov. 15	E. M. D.
Twaal Creek	do	3·4	June 17	C. G. C. & K. G. C.
Venables Creek	do Venables Lake.	1·1	May 21	K. G. C.

REPORT

OF

BRITISH COLUMBIA HYDROGRAPHIC SURVEY FOR 1913

CHAPTER 7

Kootenay Boundary Division—Hydrographic Data

CHAPTER VII.

KOOTENAY BOUNDARY DIVISION—HYDROGRAPHIC DATA.

REGULAR METERING STATIONS.

AKOLKOLEX RIVER AT WIGWAM.

Location.—Section 35, township 21, range 7, west 6th meridian, about 1 mile from Wigwam, where the wagon road crosses the river just above the falls.

Records Available.—From May 1 to December 31, 1913.

Winter Conditions.—Heavy snowfall, thermometer rarely goes below zero. Stream at section seldom freezes except for a day or two.

Gauge.—Chain gauge is used, and is referred to three bench-marks. From May to October, inclusive, gauge readings are taken three times a week; during the rest of the year once a week, by J. A. Lewis, Wigwam.

Channel.—Straight for 100 yards above and below the section. The water is swift and flows through a rock box canyon for 150 yards above and below the section. The control is rock and appears very permanent.

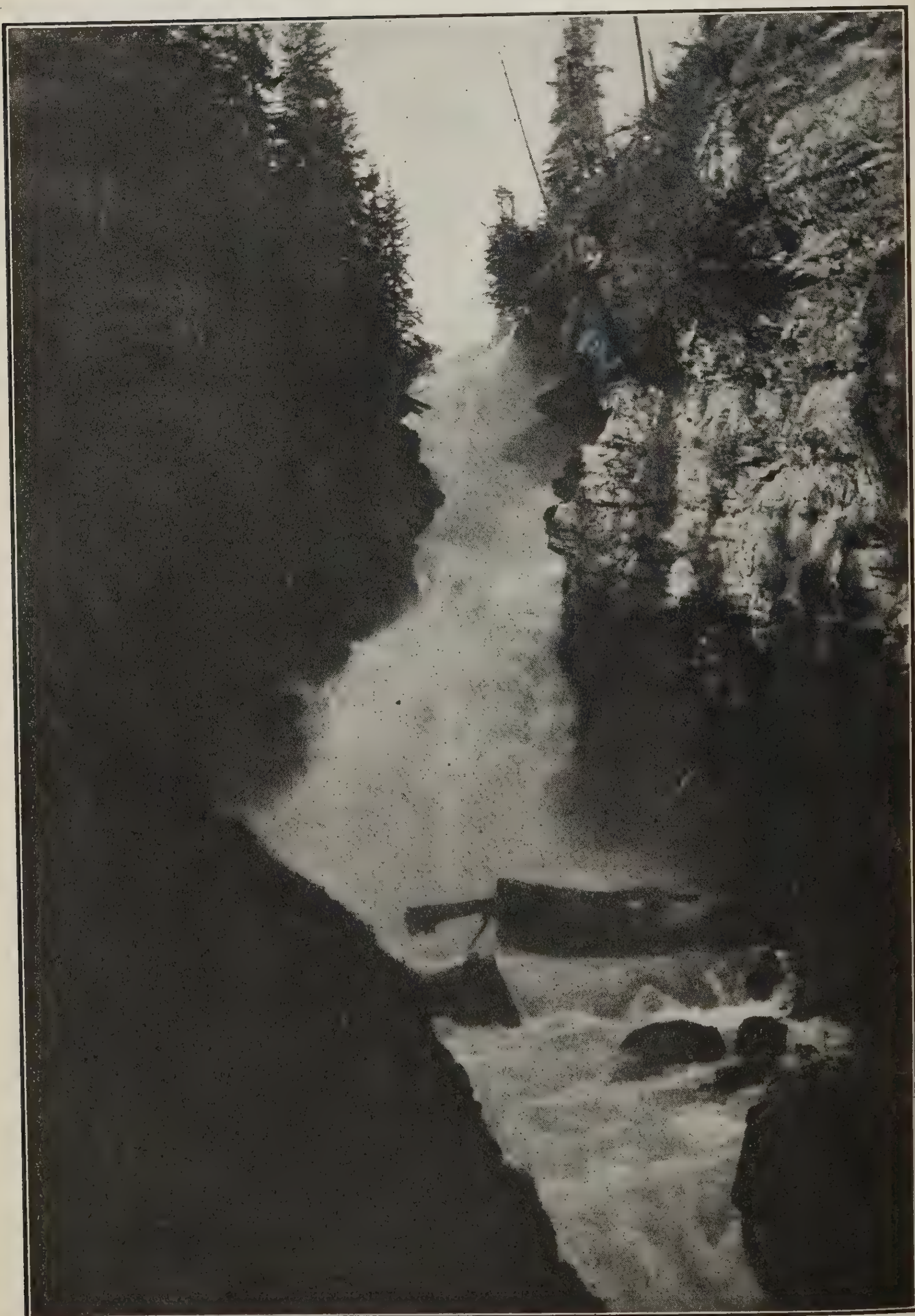
Discharge Measurements.—Measurements are made from the upstream side of the wagon bridge. It is difficult to obtain accurate soundings in high water. In 1913, ten well distributed measurements were made.

Accuracy.—Apparently very accurate measurements were made, but due to the infrequency of gauge readings the mean monthly discharge cannot be guaranteed to within 10 per cent. December gauge readings were at times affected by ice.

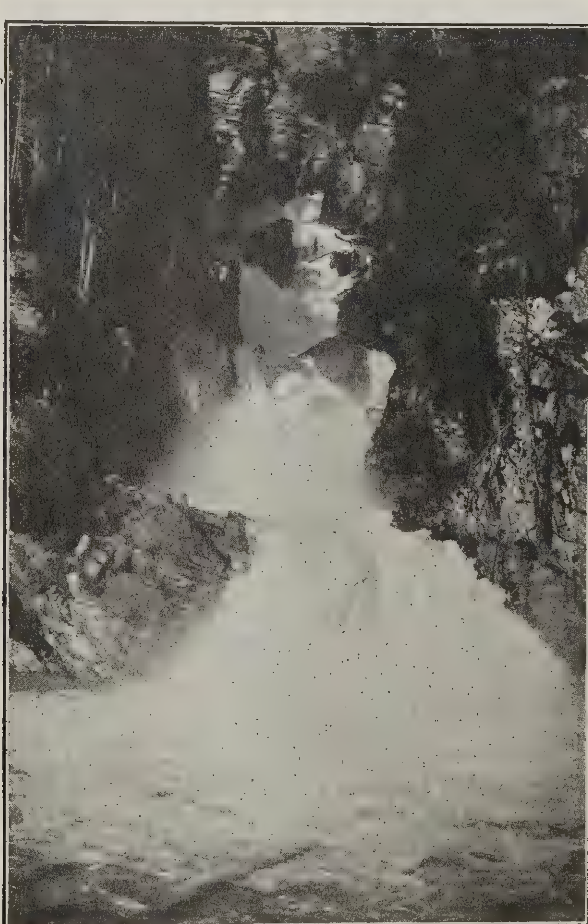
General.—Akolkolex river is a stream about 20 miles long, rising in township 24, range 28, west 5th meridian, at an elevation of about 6,000 feet, flowing in a south-westerly direction and discharging into Columbia river in township 22, range 1, west 6th meridian, near Wigwam, B.C. It drains an area of over 100 square miles of heavily timbered and unsettled country. There are various falls and canyons between its source and mouth, but the only power possibility which has been investigated is about 1 mile from the mouth. Here the river flows through a canyon for about 150 yards. This canyon is of rock, box-shaped, about 35 feet wide, from 30 to 40 feet deep. At the foot of the canyon the river falls 335 feet in a horizontal distance of 50 yards. A total head of about 400 feet may be obtained and the construction cost will not be prohibitive.

The river above the falls is suitable for driving logs, but not navigable. Valuable timbered limits are held by the Lee Lumber Company, and a good trail has been constructed to these limits near the source of the stream.

The precipitation near the source of the stream is very great, and at the mouth about 40 inches (30 inches rain and 130 inches snow). The summers are hot with considerable rain, winters not particularly severe, the thermometer seldom falling below zero, and the snowfall is very heavy.



Akolkolex River near Wigwam, B.C. Upper Falls.

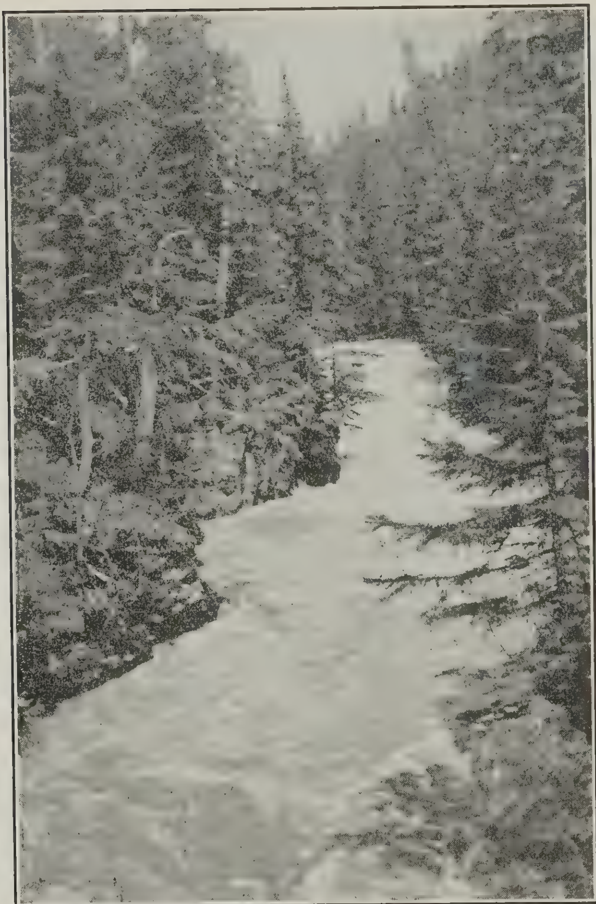


Akolkolex River near Wigwam, B.C. Lower Falls.

Discharge Measurements of Akolkolex river near Wigwam, B.C. 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
May 7	C. E. Richardson	1,048	37	157	2·56	2·35	402
May 30	J. A. Elliott	1,672	37	363	7·43	7·50	2,700
June 9	do	1,672	37	455	9·18	10·00	3,990
June 27	do	1,672	37	314	6·40	6·45	2,110
July 17	do	1,672	37	268	4·98	4·90	1,340
July 25	C. E. Richardson	1,048	39	299	5·32	5·75	1,590[1]
Aug. 13	J. A. Elliott	1,672	37	235	4·37	4·28	1,070
Sept. 16	R. G. Swan, C.E.R.	1,048	39	186	2·92	3·10	530
Nov. 20	C. E. Webb	1,048	29	106	1·71	1·75	180

Note.—[1]Section is in box canyon immediately above falls.



Akolkolex River, looking upstream from above falls.

Monthly Discharge of Akolkolex river near Wigwam, B.C., for 1913.

(Drainage area, 105 square miles).

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May	2,810	320	1,493	14·22	16·37	91,600
June	4,100	1,980	2,763	26·30	29·34	164,000
July	2,540	1,120	1,768	16·84	19·42	108,000
August	1,630	755	1,088	10·30	11·87	67,000
September	1,300	440	691	6·60	7·36	41,100
October	536	274	344	3·30	3·80	21,100
November	274	175	224	2·13	2·38	13,300
December	175	100	*127	1·21	1·40	7,810

Note.—*Estimated—Last 15 days in December.

DAILY GAUGE HEIGHTS AND DISCHARGES of Akolkolex river near Wigwam, B.C., for 1913.

Day.	May.		June.	
	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.
1	....	....	8·3	3,030
2	....	....	8·6	3,210
3	....	....	8·8	3,320
4	....	....	9·1	3,500
5	....	....	8·4	3,090
6	....	....	7·8	2,760
7	2·3	320	9·0	3,440
8	3·0	336	10·1	4,100
9	3·7	795	10·0	4,040
10	4·4	1,080	9·6	3,800
11	4·3	1,040	9·2	3,560
12	4·2	1,000	8·8	3,320
13	4·2	1,000	8·2	2,980
14	4·1	858	7·6	2,650
15	4·0	917	6·9	2,280
16	3·9	875	7·0	2,330
17	3·9	875	7·1	2,380
18	3·9	875	7·2	2,440
19	4·0	917	7·5	2,590
20	4·2	1,000	7·7	2,710
21	5·1	1,390	7·3	2,490
22	6·1	1,880	6·9	2,280
23	6·2	1,930	6·5	2,080
24	6·3	1,980	6·5	2,080
25	6·7	2,180	6·5	2,080
26	7·1	2,380	6·4	2,030
27	7·5	2,590	6·4	2,030
28	7·6	2,650	6·4	2,030
29	7·8	2,760	6·3	1,980
30	7·5	2·590	6·9	2,280
31	7·9	2,810	....	....

DAILY GAUGE HEIGHTS AND DISCHARGES of Akolkolex river near Wigwam, B.C., for 1913—*Continued.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	7·4	2,540	4·9	1,300	3·9	875	2·6	410	2·1	274	1·7	175
2	6·9	2,280	3·0	1,340	4·1	958	2·5	381	2·1	274	1·7	175
3	6·4	2,030	5·2	1,440	4·4	1,080	2·5	381	2·1	274	1·6	160
4	5·9	1,780	5·4	1,530	4·7	1,220	2·4	353	2·1	274	1·6	160
5	6·4	2,030	5·6	1,630	4·9	1,300	2·3	326	2·1	274	1·6	160
6	6·9	2,280	5·2	1,440	4·5	1,120	2·2	300	2·1	274	1·6	160
7	7·3	2,490	4·8	1,260	4·2	1,000	2·1	274	2·1	274	1·5	145
8	6·7	2,180	4·8	1,260	4·0	917	2·1	274	2·0	249	1·5	145
9	6·0	1,830	4·8	1,260	3·7	795	2·1	274	2·0	249	1·5	145
10	3·8	1,730	4·9	1,300	3·7	795	2·1	274	2·0	249	1·5	145
11	3·6	1,630	5·0	1,340	3·5	716	2·3	326	2·0	249	1·4	130
12	5·4	1,530	5·1	1,390	3·3	641	2·4	353	1·9	224	1·4	130
13	5·2	1,440	4·3	1,040	3·3	641	2·6	410	1·9	224	1·4	130
14	5·0	1,340	4·1	958	3·2	605	3·0	536	1·9	224	1·4	130
15	4·9	1,300	4·0	917	3·1	570	3·0	536	1·9	224	1·4	130
16	4·8	1,260	4·0	917	3·1	570	2·6	410	1·8	194	1·35	122
17	4·9	1,300	4·0	917	3·1	570	2·5	381	1·8	199	1·35	122
18	4·9	1,300	3·9	875	3·1	570	2·4	353	1·8	199	1·35	122
19	6·3	1,980	3·9	875	3·1	570	2·4	353	1·8	199	1·35	122
20	6·6	2,130	3·7	795	3·0	536	2·4	353	1·8	199	1·30	115
21	6·8	2,230	3·6	755	3·0	536	2·4	353	1·8	199	1·30	115
22	7·0	2,330	3·7	795	3·0	536	2·4	353	1·8	199	1·30	115
23	7·1	2,380	3·8	835	2·9	503	2·3	326	1·8	199	1·20	100
24	6·6	2,130	3·9	875	2·8	471	2·3	326	1·8	199	1·20	100
25	5·9	1,780	4·0	917	2·7	440	2·3	326	1·8	199	1·20	100
26	5·4	1,530	4·1	958	2·7	440	2·2	300	1·8	199	1·20	100
27	5·0	1,340	4·1	958	2·7	440	2·2	300	1·8	199	1·20	100
28	4·5	1,120	4·2	1,000	2·7	440	2·2	300	1·7	175	1·20	100
29	4·6	1,170	4·2	1,000	2·7	440	2·1	274	1·7	175	1·20	100
30	4·6	1,170	4·1	958	2·7	440	2·1	274	1·7	175	1·20	100
31	4·8	1,260	4·0	917	....	....	2·1	274	....	....	1·11	100

BEAVER RIVER AT SIX-MILE CREEK.

Location.—Township 29, range 25, west 5th meridian, 4 miles from the mouth, about 150 yards from the railway station at Six-mile creek, on the downstream side of the lumber company's bridge.

Records Available.——From May 24 to November 1, 1913.

Winter Conditions.—Severe (-30° F.) with heavy snowfall. Ice conditions exist generally from November to the end of March. Frazil ice is to be contended with.

Gauge.—Chain gauge is used and referred to three bench-marks. Wm. McCreary reads the gauge daily at 5 p.m., at which time the river during the summer freshet is considered to be at a mean height for the day.

Channel.—Straight for 100 yards above and below the section. The river is very swift during high water, and accurate soundings can only be made at low water. During the freshet in June, July and August, water flows through two or three small side channels. As yet the control has not been studied, but appears permanent.

Discharge Measurements.—Measurements are made from the downstream side of the bridge. In 1913, ten discharge measurements were made, one of which was made under ice conditions on December 3, giving a discharge of 330 c.f.s.

Accuracy.—The gauge-height-discharge curve shows a close accuracy though the section does not appear to be good. The fact that during the summer the

river varies greatly on a warm day depreciates the accuracy of the gauge reading. The 1913 data are within 15 per cent only.

General.—Beaver river has its source in the Grand glacier of the Selkirk range at Duncan pass in township 24, range 24, west 6th meridian, at an elevation of about 6,000 feet. It is 40 miles long, and flows in a northerly direction, discharging into the Columbia near Beavermouth, at an elevation of about 2,500 feet. It drains an area of about 400 square miles of heavily timbered, very mountainous country. The C.P.R. main line runs up the valley from Beavermouth for 15 miles to Bear creek near Rogers pass, and the river, in its lower reaches, winding across a broad valley, is familiar to thousands of tourists. Its upper reaches are uninhabited except at Rogers pass, and only C.P.R. employees and a lumber camp may be found near the mouth.

The scattered bits of agricultural lands have not been taken up and at present the only industry in this watershed is lumbering. In 1913 the McCreary Lumber Company started operations at Six-mile creek. Valuable limits are held by the company.

There are no pronounced falls or rapids in the upper part of the river, but near the mouth there is the Natural Arch (or Gateway) close to the railway. There is a fall in the river of about 80 feet in a distance of 3,000 feet, the river being only from 20 to 40 feet wide with rocky banks. At the head of the rapids the C.P.R. rail is only 15 feet above high-water mark, and at the foot it is 25 feet above high water. A dam at the head of the rapids would give excellent pondage. Any development is restricted by the proximity of the present grade of the railway.

DISCHARGE MEASUREMENTS of Beaver River near Six-mile Creek 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
May 24	C. E. R.	1,048	147	357	8·51	3·00	3,040
June 5	"	1,048	154	601	8·00	4·30	4,840
June 12	J. A. E.	1,672	156	656	8·26	4·65	5,420
July 7	"	1,672	150	609	8·61	4·55	5,240
July 20	"	1,672	149	485	9·20	4·20	4,460
Sept. 15	C. E. R. & R. G. S.	1,048	75	231	6·02	2·05	1,390
Dec. 3	C. E. W.	1,048	45	122	2·87	0·45	330

MONTHLY DISCHARGE of Beaver River near Six-mile Creek for 1913.

(Drainage area, 400 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
June	6,420	2,720	4,640	11·6	12·9	276,000
July	5,300	2,460	4,140	10·4	12·0	255,000
August	4,940	2,340	3,880	9·71	11·2	239,000
September	4,100	1,350	2,070	5·17	5·77	123,000
October	1,980	560	1,130	2·83	3·26	69,600

NOTE.—Station established May 24, 1913.
Gauge readings discontinued October 31, 1913.

Daily Gauge Heights and Discharges of Beaver River near Six-mile Creek for 1913.

Day.	May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	....	4·7	5,480
2	....	....	4·7	5,480
3	....	....	4·8	5,660
4	....	....	4·6	5,300
5	....	....	4·3	4,770
6	....	....	4·2	4,600
7	....	....	4·4	4,940
8	....	....	5·0	6,020
9	....	....	5·0	6,020
10	....	....	5·2	6,420
11	....	....	5·0	6,020
12	....	....	4·9	5,840
13	....	....	4·8	5,660
14	....	....	4·3	4,770
15	....	....	3·9	4,100
16	....	....	3·6	3,620
17	....	....	3·4	3,320
18	....	....	3·5	3,470
19	....	....	4·5	5,120
20	....	....	4·4	4,940
21	....	....	3·9	5,120
22	....	....	3·0	2,720
23	....	....	3·7	3,780
24	3·0	2,720	3·9	4,100
25	3·5	3,470	3·7	3,780
26	3·7	3,780	3·6	3,620
27	3·9	4,100	3·6	3,620
28	4·2	4,600	3·7	3,780
29	4·0	4,260	3·8	3,940
30	4·0	4,260	4·0	4,260
31	4·3	4,770	....	....

DAILY GAUGE HEIGHTS AND DISCHARGES of Beaver River near Six-mile Creek for 1913—*Continued.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	4·1	4,430	3·9	4,100	3·3	3,170	1·8	1,350	0·8	560	....	....
2	3·9	4,100	4·0	4,260	3·6	3,620	2·4	1,980	....	....	....	....
3	3·4	3,320	4·2	4,600	3·9	4,100	2·1	1,640	....	....	0·45	350
4	3·3	3,170	4·1	4,430	3·1	2,870	1·8	1,350	....	....	....	....
5	3·5	3,470	4·0	4,260	3·2	3,020	1·8	1,350	....	....	....	....
6	3·9	4,100	3·9	4,100	2·8	2,460	1·9	1,440	....	....	....	....
7	4·6	5,300	4·3	4,770	2·7	2,340	1·7	1,260	....	....	....	....
8	3·9	4,100	4·4	4,940	2·7	2,340	1·7	1,260	....	....	....	....
9	4·0	4,260	4·1	4,430	2·6	2,220	1·8	1,350	....	....	....	....
10	4·3	4,770	4·2	4,600	2·5	2,100	1·7	1,260	....	....	....	....
11	4·0	4,260	4·1	4,430	3·0	2,720	1·7	1,260	....	....	....	....
12	3·9	4,100	4·0	4,260	2·6	2,220	1·6	1,170	....	....	....	....
13	3·5	3,470	3·9	4,100	2·7	2,340	1·7	1,260	....	....	....	....
14	3·3	3,170	3·7	3,780	2·5	2,100	1·6	1,170	....	....	....	....
15	3·0	2,720	3·8	3,940	2·1	1,640	1·7	1,260	....	....	....	....
16	3·1	2,870	3·6	3,620	2·0	1,540	1·7	1,260	....	....	....	....
17	3·0	2,720	3·5	3,470	2·0	1,540	1·6	1,170	....	....	....	....
18	2·8	2,460	3·3	3,170	2·5	2,100	1·7	1,260	....	....	....	....
19	4·1	4,430	3·4	3,320	2·1	1,640	1·6	1,170	....	....	....	....
20	4·6	5,300	3·0	2,720	2·0	1,540	1·6	1,170	....	....	....	....
21	4·5	5,120	2·7	2,340	2·2	1,750	1·5	1,080	....	....	....	....
22	4·6	5,300	3·2	3,020	2·0	1,540	1·4	1,000	....	....	....	....
23	4·6	5,300	3·9	4,100	1·9	1,440	1·3	920	....	....	....	....
24	4·6	5,300	3·8	3,940	1·9	1,440	1·2	840	....	....	....	....
25	4·6	5,300	3·6	3,620	1·8	1,350	1·1	770	....	....	....	....
26	4·5	5,120	3·8	3,940	1·9	1,440	1·1	770	....	....	....	....
27	4·5	5,120	3·5	3,470	1·8	1,350	1·0	700	....	....	....	....
28	4·4	4,940	3·8	3,940	1·9	1,440	1·1	770	....	....	....	....
29	3·8	3,940	3·6	3,620	1·8	1,350	1·0	700	....	....	....	....
30	3·0	2,720	3·4	3,320	1·8	1,350	0·8	560	....	....	....	....
31	3·6	3,620	3·7	3,780	....	....	0·9	630	....	....	....	....

BLAEBERRY RIVER.

Location.—South-west ¼ section 29, township 28, range 22, west 5th meridian, 11 miles north of Golden, about 1 mile from the mouth, on the downstream side of the C.P.R. bridge.

Records Available.—April 15, 1912, to November 14, 1912; June 1, 1913, to November 30, 1913.

Winter Conditions.—Severe (-30 °F.) with heavy snowfall. Ice conditions exist generally from the middle of November to the 1st of April. Frazil ice.

Gauge.—A vertical staff gauge is used and read three times a week, by H. M. Cooper, during the open season.

Channel.—The channel is straight for about 50 yards above and below the station. The water is swift and controlled by a sandbar about 100 yards downstream. This bar probably shifts. Exceedingly high water on the Columbia may effect the gauge readings.

Discharge Measurements.—Measurements are made from the downstream side of the railway bridge. In 1912 eight meterings were made, one of which was made on the 21st of February under ice conditions, the discharge was 53 c.f.s; in 1913 nine meterings were made, which formed a gauge-height-discharge curve varying considerably from that of 1912.

Accuracy.—Due to the infrequency of gauge readings and the apparent non-permanency of the control, the results are guaranteed only to be within 15 per cent.

Discharge Measurements of Blaeberry River at C. P. R. Bridge 1911-13.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
1911.							
Oct. 16......	C. E. Richardson............	1,048	68	177	1·75	0·90	310·0
Feb. 21......	"	1,048	51	148	0·413	....	(1)53·5
1912.							
June 6......	H. C. Hughes................	1,055	70	199	2·43	1·40	484·0
June 7......	"	1,055	78	237	3·15	1·905	746·0
June 25......	"	1,055	86	398	7·28	3·50	2,900·0
July 11......	"	1,055	80	293	4·52	2·72	1,330·0
July 27......	"	1,055	80	279	4·08	2·43	1,140·0
Oct. 3......	C. E. Richardson............	1,055	70	215	2·40	1·40	512·0
1913.							
May. 24......	J. A. Elliott..................	1,672	80	290	4·59	2·45	1,330·0
June 15......	"	1,672	82	340	5·90	3·10	2,010·0
July 5......	"	1,672	81	310	4·94	2·70	1,500·0
July 5......	"	1,672	83	310	4·89	2·70	1,510·0
July 23......	"	1,672	83	360	6·36	3·32	2,290·0
Aug. 2......	"	1,672	80	341	6·33	3·15	2,160·0
Sept. 5......	C. E. Richardson............	1,048	80	335	5·60	3·02	1,880·0
Sept. 16......	J. A. Elliott..................	1,672	75	250	3·64	1·90	910·0
Nov. 30......	C. E. Webb..................	1,048	52	154	1·38	0·50	212·0

Note—(1) Ice conditions.

Monthly Discharge of Blaeberry River at Golden for 1913.

(Drainage area, 325 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
June..........................	3,460	1,530	2,449	7·54	8,41	146,000
July..........................	2,740	1,270	1,875	5·77	6·65	115,000
August..........................	2,740	1,030	1,838	5·66	6·52	113,000
September..........................	1,440	720	1,058	3·26	3·64	63,000
October..........................	900	370	607	1·87	2·16	37,300
November..........................	415	170	274	0·84	0·94	16,300

Daily Gauge Heights and Discharges of Blaeberry River near Golden for 1913.

Day.	June.		July.		August.		September.		October.		November.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	3·8	3,100	3·5	2,580	3·2	2,120	2·4	1,270	1·9	900	0·9	370
2	3·7	2,920	3·2	2,120	3·4	2,420	2·5	1,350	1·7	775	1·0	415
3	3·5	2,580	2·9	1,730	3·5	2,580	2·5	1,350	1·6	720	1·0	415
4	3·4	2,420	2·8	1,620	3·6	2,740	2·6	1,440	1·6	720	0·9	370
5	3·3	2,270	2·8	1,620	3·6	2,740	2·6	1,440	1·5	665	0·9	370
6	3·4	2,420	2·9	1,730	3·5	2,580	2·5	1,350	1·5	665	0·9	370
7	3·5	2,580	3·0	1,850	3·5	2,580	2·5	1,350	1·5	665	0·9	370
8	3·7	2,920	3·1	1,980	3·5	2,580	2·6	1,440	1·6	720	0·8	330
9	3·8	3,100	3·0	1,850	3·4	2,420	2·5	1,350	1·6	720	0·8	330
10	3·8	3,100	2·9	1,730	3·3	2,270	2·4	1,270	1·7	775	0·7	290
11	3·7	2,920	2·9	1,730	3·2	2,120	2·3	1,190	1·8	835	0·7	290
12	3·7	2,920	2·8	1,620	3·2	2,120	2·2	1,110	1·7	775	0·6	250
13	3·6	2,740	2·7	1,530	3·1	1,980	2·0	965	1·5	665	0·6	250
14	3·4	2,420	2·5	1,350	3·0	1,850	2·1	1,030	1·5	665	0·5	210
15	3·1	1,980	2·5	1,350	2·8	1,620	2·2	1,110	1·4	610	0·4	170
16	2·9	1,730	2·4	1,270	2·8	1,620	2·1	1,030	1·4	610	0·6	250
17	2·7	1,530	2·5	1,350	2·7	1,530	2·0	965	1·3	555	0·7	290
18	3·4	2,120	2·6	1,440	2·7	1,530	2·0	965	1·2	505	0·7	290
19	4·0	3,460	2·8	1,620	2·6	1,440	2·0	965	1·2	505	0·6	250
20	3·9	3·280	3·1	1,980	2·5	1,350	1·9	900	1·3	555	0·6	250
21	3·8	3,100	3·4	2,420	2·3	1,190	1·9	900	1·3	555	0·5	210
22	3·5	2,580	3·5	2,580	2·2	1,110	1·9	900	1·4	610	0·5	210
23	3·1	1,980	3·6	2,740	2·1	1,030	1·8	835	1·3	555	0·5	210
24	3·1	1,980	2·5	2,580	2·3	1,190	1·7	775	1·1	460	0·5	210
25	3·0	1,850	3·4	2,420	2·5	1,350	1·6	720	1·1	460	0·5	210
26	2·9	1,730	3·3	2,270	2·8	1,620	1·6	720	1·1	460	0·5	210
27	2·8	1,620	3·2	2,120	2·7	1,530	1·6	720	1·1	460	0·5	210
28	3·0	1,850	3·0	1,850	2·6	1,440	1·6	720	1·1	460	0·5	210
29	3·2	2,120	2·9	1,730	2·6	1,440	1·7	775	1·0	415	0·5	210
30	3·0	1,850	2·7	1,530	2·7	1,530	1·8	835	1·0	415	0·5	210
31	....	....	3·0	1,850	2·5	1,350	....	....	0·9	370	....	....

BUGABOO CREEK.

Location.—About 3 miles southwest of Spillimacheen Landing, 40 miles south of Golden, on the downstream side of the highway bridge, 1 mile from the mouth.

Records Available.—June to October, 1912; June to November, 1913.

Winter Conditions.—Severe (-40 °F.) with heavy snowfall, the creek usually freezes over in November and does not open again till April. Frazil ice.

Gauge.—Vertical staff gauge fastened to the pier of the bridge, and read daily, during the open season, by Jas. Montgomery.

Channel.—Straight for 100 feet above and below the gauge; the water is swift during freshet; there is one channel in low water, and two in high water.

Discharge Measurements.—Meterings are taken from the downstream side of the bridge, four being taken in 1912, and eight in 1913.

Accuracy.—The control has not been thoroughly studied. The 1913 gauge heights do not give the same discharges as corresponding gauge heights in 1912; a slight possibility of backwater from the Columbia river when the latter stream is extremely high; 1913 results on the Bugaboo are guaranteed to be within 10 per cent.

Discharge Measurements of Bugaboo River near Spillimacheen, 1912-13.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sec.-ft.	Ft. per sec.	Feet.	Sec.-ft.
1912.							
June 1	H. C. Hughes	1,055	33·0	96·3	2·89	1·45	278
June 8	do	1,055	60·0	138·0	6·08	2·40	839
July 16	do	1,055	59·0	128·0	5·34	2·15	684
Sept. 29	C. E. Richardson	1,055	33·0	858·0	1·87	1·02	161
1913							
May 20	J. A. Elliott	16,72	34·5	103·0	2·94	1·35	303
June 23	do	16,72	60·0	152·0	6·88	2·40	1,040
July 11	C. E. Richardson	1,048	60·0	150·0	6·87	2·40	1,030
July 27	J. A. Elliott	1,072	60·0	158·0	6·66	2·38	1,050
July 30	do	1,672	60·0	130·0	5·70	2·05	744
Sept. 3	C. E. R. & R. G. S.	1,048	34·0	118·0	4·04	1·85	478
Sept. 14	J. A. Elliott	1,672	34·0	111·0	3·65	1·69	406
Nov. 26	C. E. Webb	1,048	33·0	84·7	1·36	1·00	115

Monthly Discharge of Bugaboo River near Spillimacheen for 1913.

(Drainage area, 190 square miles.)

Month.	(Discharge in Second-Feet.)				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
June	2,910	820	1,654	8·70	9·71	98,200
July	1,650	570	1,070	5·63	6·49	65,800
August	1,390	510	878	4·62	5·33	54,000
September	1,790	350	569	2·99	3·34	33,900
October	400	160	292	1,54	1·78	17,900
November	220	85	145	0·76	0·85	8,630

Daily Gauge Heights and Discharges of Bugaboo River near Spillimacheen for 1913.

Day.	May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	....	3·0	1,790
2	....	....	3·0	1,790
3	....	....	3·1	1,930
4	....	....	3·1	1,930
5	....	....	3·1	1,930
6	....	....	2·9	1,650
7	....	....	2·9	1,650
8	....	....	3·3	2,210
9	....	....	3·8	2,910
10	....	....	3·6	2,630
11	....	....	3·5	2,490
12	....	....	3·5	2,490
13	....	....	3·2	2,070
14	....	....	3·1	1,930
15	....	....	3·0	1,790
16	....	....	2·4	1,040
17	....	....	2·2	820
18	....	....	2·3	930
19	....	....	2·4	1,040
20	1·4	305	2·9	1,650
21	1·5	350	2·6	1,270
22	1·8	510	2·5	1,150
23	2·0	640	2·4	1,040
24	2·1	720	2·6	1,270
25	2·2	820	2·7	1,390
26	2·5	1,150	2·7	1,390
27	2·6	1,270	2·7	1,390
28	2·7	1,390	2·6	1,270
29	2·7	1,390	2·7	1,390
30	2·7	1,390	2·7	1,390
31	2·8	1,520	....	....

DAILY GAUGE HEIGHTS AND DISCHARGES of Bugaboo River near Spillimacheen for 1913—*Continued.*

Day.	July.		August.		September.		October.		November.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	2·7	1,390	2·4	1,040	1·9	570	1·5	350	1·1	185
2	2·6	1,270	2·5	1,150	1·7	450	1·6	400	1·1	185
3	2·4	1,040	2·6	1,270	1·8	510	1·5	350	1·0	160
4	2·4	1,040	2·5	1,150	3·0	1,790	1·5	350	1·2	220
5	2·3	930	2·6	1,270	2·8	1,520	1·4	305	1·1	185
6	2·3	930	2·7	1,390	2·2	820	1·5	350	1·0	160
7	2·9	1,650	2·5	1,150	2·0	640	1·5	350	1·0	160
8	2·6	1270	2·7	1,390	1·9	570	1·6	400	1·1	185
9	2·5	1,150	2·4	1,040	2·1	720	1·5	350	1·1	185
10	2·5	1,150	2·3	930	1·9	570	1·4	305	1·1	185
11	2·4	1,040	2·3	930	1·8	510	1·5	350	1·1	185
12	2·3	930	2·5	1,150	1·8	510	1·6	400	1·0	160
13	2·3	930	2·5	1,150	1·8	510	1·6	400	1·0	160
14	2·1	720	2·2	820	1·7	450	1·5	350	1·0	160
15	2·0	640	2·1	720	1·6	400	1·4	305	1·1	185
16	1·9	570	1·9	570	1·6	400	1·4	305	1·1	185
17	1.9	570	1·9	570	1·7	450	1·4	305	1·0	160
18	2·1	720	1·9	570	2·1	720	1·3	260	1·0	160
19	2·2	820	1·9	570	1·8	510	1·3	260	1·0	160
20	2·6	1,270	1·8	510	1·6	400	1·2	220	0·3	85
21	2·7	1,390	1·8	510	1·6	400	1·2	220	Mean for 10 days = ·05.	Discharge = 950 (10 days).
22	2·8	1,520	2·0	640	1·8	510	1·2	220		
23	2·9	1,650	2·0	640	1·6	400	1·2	220		
24	2·7	1,390	2·2	820	1·6	400	1·4	305		
25	2·7	1,390	2·1	720	1·5	350	1·2	220		
26	2·5	1,150	2·2	820	1·5	350	1·2	220		
27	2·5	1,150	2·1	720	1·6	400	1·2	220		
28	2·3	930	2·0	640	1·6	400	1·2	220		
29	2·3	930	2·1	720	1·7	450	1·1	185		
30	2·2	820	2·2	820	1·6	400	1·0	160		
31	2·2	820	2·2	820	....	....	1·1	185		

COLUMBIA RIVER, GOLDEN.

Location.—Southwest ¼ section 12, township 27, range 22, west 5th meridian, above mouth of Kicking Horse river, 1 mile from Golden, B. C., 100 yards below the Columbia River Lumber Company's mill.

Records Available.—During the open season from 1903–13. Gauge heights from 1903–11 were obtained through the courtesy of the Columbia River Lumber Company. One ice measurement made in February, 1912, gave discharge of 795 c.f.s., and one made in February, 1914, gave discharge of 894 c.f.s.

Winter Conditions.—The winters are severe (-40 °F.) with heavy snowfall. Ice conditions generally exist from the middle of November to the end of March.

Gauge.—Vertical staff gauge referred to three bench-marks, and read daily by the Columbia River Lumber Company, during the open season.

Channel.—The section is located in the middle of a straight stretch of river of 1,500 feet. At low water there is a pronounced riffle 300 yards below gauge but at high water this riffle disappears.

Discharge Measurements.—Measurements are made from boat held by temporary cable about 100 yards below mill, eight discharge measurements were made in 1912, and five in 1913.

Accuracy.—The gauge readings are good. Great difficulty is encountered in metering river at high water, and during June and July accuracy is not guaranteed to within 15 per cent, but in the remaining months it is probably within 10 per cent.

DISCHARGE MEASUREMENTS of Columbia River near Golden, B. C., 1911–12-13.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1911.			Feet.	Sq. ft.	Ft. per sec.	Ft. In.	Sec. ft.
Oct. 17	C. E. Richardson	1048	176	792	2·36	10 9	1,870
1912.							
Feb. 20	"	1048	175	615	1·27	....	795[1]
June 4	H. C. Hughes	1055	200	1,030	3·02	9 2·0	3,100
" 8	"	1055	220	1,270	3·52	8 0·6	4,490
" 24	"	1055	440	2,485	4·35	5 0·6	10,800
July 24	"	1055	385	1,910	4·60	5 4·3	8,820
" 28	"	1055	373	2,010	4·14	5 7·7	8,300
Oct. 1	C. E. Richardson	1055	180	798	2·53	10 6·0	2,020
1913.							
May 23	J. A. Elliott	1672	200	1,060	3·42	3 7·0	3,620[2]
June 16	C. E. R and J. A. E	1672	400	3,710	5·40	2 1·5	20,000
July 4	" "	1672	400	2,690	4·20	4 0·0	11,300
Sept. 16	J. A. Elliott	1672	270	1,280	4·17	8 1·0	5,340[3]
Nov. 24	C. E. Webb	1048	185	764	2·20	18 3·0	1,670[3]

[1] Ice conditions. [2] Different gauge. [3] 8′ 1″ on one gauge = 4·48 on other; zero on one gauge (feet and inches) at top, zero on other gauge (feet and tenths) at bottom.

MONTHLY DISCHARGE of Columbia River near Golden, B. C., for 1913.

(Drainage area, 2,500 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
April	2,000	1,530	1,647	0·66	0·74	97,600*
May	9,300	1,600	3,627	1·45	1·67	22,300
June	18,600	9,760	14,402	5·76	6·43	857,000
July	12,600	9,070	11,154	4·46	5·14	688,000
August	9,760	6,660	8,303	3·32	3·83	510,000
September	8,840	6,610	6,817	2·73	3·05	405,000
October	6,060	2,660	3,875	1·55	1·79	238,000
November	2,560	1,320	1,873	0·74	0·83	111,000

* First 11 days estimated.

DAILY GAUGE HEIGHTS AND DISCHARGES of Columbia River near Golden for 1913.

Day.	April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	....	10·9	1,750	5·4	9,760
2	....	....	10·10	1,750	5·1	10,200
3	....	....	10·10	1,750	4·9	10,900
4	....	....	10·10	1,750	4·6	11,600
5	....	....	10·11	1,670	4·4	12,000
6	....	....	11·0	1,600	4·2	12,200
7	....	....	11·0	1,600	4·0	12,600
8	....	....	11·0	1,600	3·10	13,100
9	....	....	10·8	1,830	3·8	13,400
10	....	....	10·6	2,000	3·2	14,900
11	....	....	10·4	2,180	2·10	16,100
12	....	....	10·0	2,460	2·6	17,000
13	....	....	10·0	2·460	2·1	18,200
14	11·1	1,530	9·10	2,660	2·0	18,600
15	10·11	1,670	9·8	2,760	2·1	18,200
16	10·8	1,830	9·6	2,960	2·1	18,200
17	10·6	2,000	9·8	2,760	2·1	18,200
18	10·6	2,000	9·8	2,760	2·0	18,600
19	10·6	2,000	9·8	2,760	2·2	17,900
20	10·6	2,000	9·9	2,660	2·4	17,600
21	10·6	2,000	9·11	2,560	3·0	15,500
22	10·7	1,910	8·0	5,010	3·8	13,400
23	10·7	1,910	8·4	4,560	3·9	13,400
24	10·8	1,830	7·10	5,310	3·9	13,400
25	10·8	1,830	7·6	5,760	3·10	13,100
26	10·8	1,830	7·2	6,210	3·11	12,800
27	10·9	1,750	7·1	6,360	3·9	13,400
28	10·9	1,750	6·9	6,960	4·0	12,600
29	10·9	1,750	6·3	7,610	4·0	12,600
30	10·9	1,750	5·8	9,070	4·0	12,600
31	....	....	5·6	9,300	....	....

DAILY GAUGE HEIGHTS AND DISCHARGES of Columbia River near Golden for 1913—*Continued.*

Day.	July.		August.		September.		October.		November.	
	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	4·0	12,600	5·7	9,070	7·0	6,510	7·4	6,060	9·11	2,560
2	4·0	12,600	5·7	9,070	7·0	6,510	7·4	6,060	9·11	2,560
3	4·0	12,600	5·6	9,300	7·0	6,510	7·3	6,060	10·0	2,460
4	4·0	12,600	5·6	9,300	7·0	6,510	7·8	5,460	10·0	2,460
5	4·1	12,400	5·6	9,300	7·2	6,210	8·0	5,010	10·1	2,360
6	4·2	12,200	5·5	9,530	7·3	6,060	8·0	5,010	10·1	2,360
7	4·3	12,200	5·5	9,530	7·3	6,060	8·2	4,710	10·3	2,180
8	4·4	12,000	5·5	9,530	7·5	5,910	8·4	4,560	10·3	2,180
9	4·5	11,800	5·4	9,760	7·4	6,060	8·7	4,110	10·3	2,180
10	4·5	11,800	5·4	9,760	7·2	6,210	8·9	3,810	10·4	2,180
11	4·6	11,600	5·8	8,840	7·0	6,510	8·9	3,810	10·4	2,180
12	4·6	11,600	5·8	8,840	6·5	7,440	8·9	3,810	10·5	2,090
13	4·7	11,400	5·9	8,610	6·2	7,790	8·9	3,810	10·6	2,000
14	4·7	11,400	5·9	8,610	5·8	8,840	8·10	3,810	10·8	1,830
15	4·7	11,400	5·10	8,610	5·8	8,840	8·10	3,810	10·8	1,830
16	4·8	11,100	5,10	8,610	5·8	8,840	8·11	3,670	10·9	1,750
17	4·8	11,100	6·0	8,180	5·9	8,610	8·11	3,670	10·10	1,750
18	4·10	10,900	6·1	7,980	6·0	8,180	9·0	3,540	10·10	1,750
19	5·0	10,400	6·2	7,790	6·1	7,980	9·2	3,300	10·10	1,750
20	5·4	9,760	6·4	7,610	6·5	7,440	9·3	3,180	10·10	1,750
21	5·6	9,300	6·4	7,610	6·7	7,110	9·3	3,180	10·11	1,670
22	5·7	9,070	6·2	7,790	6·8	6,960	9·3	3,180	11·0	1,600
23	5·6	9,300	6·2	7,790	7·0	6,510	9·3	3,180	11·2	1,460
24	5·4	9,760	6·3	7,610	7·3	6,060	9·4	3,180	11·4	1,390
25	5·2	9,990	6·5	7,440	7·6	5,760	9·5	3,070	11·5	1,320
26	5·0	10,400	6·7	7,110	7·7	5,610	9·5	3,070	11·5	1,320
27	4·10	10,900	6·8	6,960	7·6	5,760	9·6	2,960	11·5	1,320
28	4·9	10,900	6·9	6,960	7·5	5,910	9·6	2,960	11·5	1,320
29	4·9	10,900	6·10	6,810	7·5	5,910	9·8	2,760	11·5	1,320
30	4·9	10,900	6·10	6,810	7·5	5,910	9·10	2,660	11·5	1,320
31	4·9	10,900	6·11	6,660	....	....	9·10	2,660	....	....

COLUMBIA RIVER NEAR REVELSTOKE.

Location.—Southeast ¼ section 33, township 23, range 2, west 6th meridian, above the mouth of the Illicillewaet river on the downstream side of the highway bridge near Revelstoke.

Records Available.—1912–13, during open season.

Winter Conditions.—Severe with heavy snowfall; ice conditions exist generally from November to the end of March. Frazil ice.

Gauge.—Chain gauge used and daily readings taken during open season by J. H. Jones.

Channel.—About 1,000 feet wide, controlled by a fairly permanent sandbar 500 yards below. Shift in 1913 apparently caused by the building of a break-water at the control.

Discharge Measurements.—Eleven well distributed measurements taken during 1911-12-13. Miscellaneous ice cover metering taken on February 27, 1912. Discharge 4,460 c.f.s.

Accuracy.—Accurate gauge reading, fair conditions for metering. These results are guaranteed to be within 5 per cent.

DISCHARGE MEASUREMENTS of Columbia river near Revelstoke, B. C., 1911-12-13.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Height.	Discharge
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
1911.							
Oct. 12	C. E. Richardson	1048	705	4,990	2·66	5·45	13,300
1912.							
Feb. 27	"	1048	523	3,160	1·41	....	[1]4,460
April 19	"	1048	710	5,140	2·60	5·54	13,000
June 18	"	1048	960	12,500	7·80	15·50	96,900
June 24	"	1048	1,070	15,700	8·60	18·20	135,000
Aug. 20	"	1048	840	10,200	6·40	12·75	65,500
Sept. 14	"	1055	825	7,570	4·80	9·20	36,400
Oct. 9	"	1055	710	6,230	3·10	7·30	[2]19,700
1913.							
May 5	"	1048	705	5,040	2·40	5·60	[3]12,300
May 26	"	1048	840	10,100	6·02	12·82	61,800
June 7	"	1048	1,055	13,400	7·60	16·30	102,000
Sept. 17	"	1048	825	7,340	4·33	9·20	31,800

[1] Ice conditions. [2] Various widths. [3] Include piers.

MONTHLY DISCHARGE of Columbia river near Revelstoke for 1913.

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
April	21,800	8,090*	12,247	1·36	1·51	726,000
May	94,500	12,300	36,500	4·05	4·67	2,240,000
June	148,000	83,600	109,900	12·21	13·62	6,490,000
July	109,000	61,100	84,400	9·38	10·81	5,190,000
August	95,800	47,300	73,000	8·11	9·35	4,490,000
September	71,100	23,400	39,400	4·38	4·89	2,340,000
October	24,000	13,000	17,209	1·91	2·20	1,060,000
November	13,000	9,860	11,209	1·24	1·38	666,000

NOTE.—*Minimum discharge in second-feet for April is estimated.

Daily Gauge Heights and Discharges of Columbia river near Revelstoke. for 1913.

Days.	April.		May.		June.	
	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.
	Feet.	Sec-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	....	6·0	13,800	16·2	101,000
2	....	....	5·9	13,400	16·7	107,000
3	....	....	5·9	13,400	17·3	115,000
4	....	....	5·8	13,000	16·6	106,000
5	....	....	5·7	12,700	16·4	104,000
6	....	....	5·6	12,300	16·3	102,000
7	....	....	5·8	13,000	16·3	102,000
8	....	....	5·9	13,400	17·3	115,000
9	....	....	5·9	13,400	18·0	125,000
10	....	....	7·6	21,800	19·1	142,000
11	....	....	7·9	23,400	19·5	148,000
12	....	....	8·2	25,200	19·5	148,000
13	....	....	8·4	26,400	19·3	145,000
14	4·1	8,510	8·6	27,600	18·8	137,000
15	4·5	9,400	8·4	26,400	17·7	121,000
16	4·6	9,630	8·4	26,400	16·6	106,000
17	5·0	10,600	8·3	25,800	15·4	104,000
18	5·6	12,300	8·4	26,400	14·8	83,600
19	6·6	16,500	8·6	27,600	17·6	119,000
20	7·0	18,500	9·3	32,600	16·5	105,000
21	7·4	20,600	9·8	36,300	16·2	101,000
22	7·6	21,800	10·8	44,000	16·1	99,700
23	7·4	20,600	11·1	46,400	16·0	98,400
24	7·1	19,000	11·4	49,100	16·0	98,400
25	6·8	17,500	12·4	58,300	15·8	95,800
26	6·6	16,500	12·9	63,000	15·6	93,200
27	6·6	16,500	13·7	71,100	15·4	90,800
28	6·4	15,500	14·6	81,200	15·3	89,600
29	6·2	14,600	15·2	88,400	15·8	95,800
30	6·1	14,200	15·6	93,200	16·0	98,400
31	....	....	15·7	94,500	....	....

DAILY GAUGE HEIGHTS AND DISCHARGES of Columbia river near Revelstoke for 1913.—*Continued.*

Day.	July.		August.		September.		October.		November.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	16·5	105,000	13·9	73,200	13·3	67,000	7·8	22,900	5·8	13,000
2	16·3	98,400	15·0	86,000	13·1	65,000	7·9	23,400	5·7	12,700
3	15·0	86,000	15·6	93,200	11·0	45,600	7·9	23,400	5·6	12,300
4	14·6	81,200	15·8	95,800	13·3	67,000	7·8	22,900	5·6	12,300
5	14·3	77,700	15·7	94,500	13·7	71,100	7·3	20,100	5·6	12,300
6	15·3	89,600	15·4	90,800	13·0	64,000	6·9	18,000	5·5	12,000
7	15·5	92,000	15·0	86,000	11·5	50,000	6·3	15,100	5·5	12,000
8	15·3	89,600	14·8	83,600	10·8	44,000	6·1	14,200	5·6	12,300
9	14·8	83,600	14·5	80,000	11·1	46,400	6·4	15,500	5·6	12,300
10	14·6	81,200	14·3	77,700	10·9	44,800	6·3	15,100	5·5	12,000
11	14·3	77,700	14·7	82,400	10·4	40,800	6·4	15,500	5·4	11,700
12	14·2	76,500	14·8	83,600	9·9	37,000	6·4	15,500	5·4	11,700
13	13·9	73,200	15·0	86,000	9·9	37,000	8·0	24,000	5·2	11,100
14	13·6	70,000	14·7	82,400	10·2	39,300	7·8	22,900	5·3	11,400
15	13·4	68,000	14·3	77,700	9·8	36,300	7·0	18,500	5·2	11,100
16	13·0	64,000	13·8	72,100	9·6	34,800	6·8	17,500	5·3	11,400
17	12·7	61,100	13·1	65,000	9·2	31,800	6·8	17,500	5·2	11,100
18	12·5	59,200	12·1	55,500	10·0	37,800	6·3	15,100	4·9	10,400
19	13·6	70,000	11·9	53,700	9·6	34,800	6·3	15,100	4·9	10,400
20	14·6	81,200	11·6	50,900	9·3	32,600	6·4	15,500	4·9	10,400
21	15·6	93,200	11·2	47,300	8·7	28,300	6·3	15,100	4·8	10,100
22	16·4	104,000	11·4	49,100	9·0	30,400	6·4	15,500	4·8	10,100
23	16·5	105,000	12·2	56,400	8·6	27,600	6·4	15,500	4·8	10,100
24	16·6	106,000	12·9	63,000	8·2	25,200	6·3	15,100	4·7	9,860
25	16·8	109,000	13·1	65,000	8·0	24,000	7·0	18,500	4·8	10,100
26	16·4	104,000	13·2	66,000	8·0	24,000	6·6	16,500	4·8	10,100
27	15·7	94,500	13·3	67,000	7·9	23,400	6·3	15,100	5·0	10,600
28	15·3	89,600	13·1	65,000	8·2	25,200	6·2	14,600	5·0	10,600
29	15·1	87,200	13·4	68,000	8·1	24,600	6·1	14,200	4·9	10,400
30	13·8	72,100	13·4	68,000	7·9	23,400	5·9	13,400	4·9	10,400
31	13·2	66,000	13·2	66,000	....	....	5·8	13,000	....	....

COLUMBIA RIVER NEAR CASTLEGAR.

Location.—Castlegar precinct, Nelson Water District, below Arrow lakes and above mouth of Kootenay river, at the C.P.R. bridge near Castlegar, B.C.

Winter Conditions.—The snowfall is fairly heavy; the thermometer seldom goes below zero; the river never freezes over at this section.

Gauge.—Vertical staff gauge referred to three bench-marks, and read daily by Mr. P. G. Farmer, of Castlegar, B.C.

Channel.—Straight for 200 yards above and below the measuring section and gauge. A pronounced riffle in low water is lost during high water. The rise and fall of the river is about 25 feet.

Discharge Measurements.—Measurements are made from the upstream side of the railway bridge. Four well-distributed measurements were made during 1913, by provincial district engineer, Water Rights Branch, and one by the British Columbia Hydrographic Surveys.

Accuracy.—The gauge readings from February 1, 1913, are very reliable. The discharge measurements are well distributed, and the 1913 gauge-height-discharge curve appears good. The Kootenay river flows in 1 mile below the gauge, and it appears that the fall in this mile is only about 6 feet. This tends to show that an effect of backwater is unavoidable. Results are within 10 per cent.

General.—This station on the Columbia was established by Provincial Engineer, Water Rights Branch, Nelson, in the beginning of 1913, and taken over by the British Columbia Hydrographic surveys in October, 1913. The drainage area is about 15,000 square miles, as compared with about 10,000 at our next station above at Revelstoke. This station forms a check on Kootenay river station near mouth and Columbia at Trail which is only a few miles below. Kootenay river plus Columbia river at Castlegar should equal Columbia river at Trail. For the months in 1913, in which we had gauge readings on all these streams July to December the sum of the mean monthly discharges at the first two stations equalled to within 10 per cent the corresponding mean monthly discharges at Trail. The rise and fall of the river at this station is practically the rise and fall of Lower Arrow lake

DISCHARGE MEASUREMENTS of Columbia River near Castlegar, B.C. for 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
June 14......	W. G. L. & A. J. V...........	....	....	20,100	7·88	28·2	158,500
July 5......	do do	....	....	16,550	6·94	21·6	[1]114,850
" 22......	do do	....	....	13,800	6·24	16·4	86,150
Sept. 5......	do do	....	....	12,180	5·55	13·0	67,650
Nov. 25......	C. E. R. & A. J. V...........	1,527	440	7,730	2·04	3·2	15,300
1914.							
Jan. 14......	C. E. W. & A. J. V...........	1,048	380	6,800	1·66	1·7	11,300

NOTE.—[1]From Provincial Water Rights Engineer, Biker.

MONTHLY DISCHARGE of Columbia River near Castlegar, B.C., for 1913.

(Drainage area, 15,000 square miles.)

MONTH.	DISCHARGE IN SECOND-FEET.				RUN-OFF.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
*January....................................	13,900	11,200	12,500	0·83	0·96	769,000
February....................................	8,600	6,600	7,810	0·52	0·54	433,000
March....................................	6,900	6,600	6,660	0·44	0·51	409,000
April....................................	24,000	6,200	11,400	0·76	0·85	678,000
May....................................	88,800	24,500	41,000	0·73	3·15	2,520,000
June....................................	160,000	98,000	136,000	9·09	10·1	8,100,000
July....................................	123,000	86,100	101,000	6·71	7·74	6,200,000
August....................................	88,800	63,300	78,800	5·25	60·5	4,850,000
September....................................	68,800	42,700	56,900	3·79	4·23	3,390,000
October....................................	41,000	25,500	30,900	2·06	2·38	1,900,000
November....................................	25,500	15,800	20,000	1·33	1·48	1,190,000
December....................................	15,300	9,200	12,600	0·84	0·97	775,000
The year....................................	160,000	6,200	43,000	2·86	38·99	31,214,000

NOTE.—Columbia near Castlegar is immediately above mouth of Kootenay.
*Gauge heights were obtained from Provincial Water Rights Branch and it appears that the January readings are from a gauge with a different datum.

DAILY GAUGE HEIGHTS AND DISCHARGES of Columbia River near Castlegar, B.C. for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feef.	Sec.-ft.	Feet.	Sec.-ft.
1	2·55	13,900	1·25	8,600	0·6	6,900	0·3	6,200	4·9	24,500	18·5	98,000
2	2·5	13,700	1·25	8,600	0·6	6,900	0·3	6,200	4·9	24,500	19·0	101,000
3	2·5	13,700	1·25	8,600	0·6	6,900	0·3	6,200	5·0	25,000	20·7	112,000
4	2·5	13,700	1·25	8,600	0·6	6,900	0·4	6,400	5·1	25,500	21·5	116,000
5	2·5	13,700	1·25	8,600	0·6	6,900	0·4	6,400	5·1	25,500	22·5	122,000
6	2·45	13,400	1·25	8,600	0·6	6,900	0·5	6,600	5·1	25,500	23·3	127,000
7	2·40	13,200	1·25	8,600	0·6	6,900	0·5	6,600	5·1	25,500	....	130,000
8	2·40	13,200	1·2	8,400	0·6	6,900	0·5	6,600	5·2	26,000	....	133,000
9	2·35	13,000	1·2	8,400	0·6	6,900	0·5	6,600	5·2	26,000	....	136,000
10	2·35	13,000	1·2	8,400	0·6	6,900	0·6	6,900	5·5	27,500	....	140,000
11	2·35	13,000	1·2	8,400	0·6	6,900	0·7	7,100	5·7	28,500	....	144,000
12	2·35	13,000	1·2	8,400	0·6	6,900	0·9	7,500	6·0	30,000	....	148,000
13	2·25	12,600	1·2	8,400	0·6	6,900	1·0	7,800	6·3	31,500	....	152,000
14	2·25	12,600	1·2	8,400	0·6	6,900	1·3	8,800	6·4	32,000	28·2	156,000
15	2·25	12,600	1·0	7,800	0·5	6,600	1·6	10,000	6·8	34,000	28·8	160,000
16	2·15	12,200	1·0	7,800	0·5	6,600	1·9	11,200	7·1	35,500	....	158,000
17	2·15	12,200	0·95	7,650	0·5	6,600	2·0	11,600	7·3	35,500	....	156,000
18	2·15	12,200	0·95	7,650	0·5	6,600	1·8	10,800	7·6	38,000	....	154,000
19	2·10	12,000	0·80	7,300	0·5	6,600	1·9	11,200	7·7	38,500	....	152,000
20	2·10	12,000	0·75	7,200	0·5	6,600	2·0	11,600	7·9	39,500	....	150,000
21	2·10	12,000	0·70	7,100	0·4	6,400	2·1	12,000	8·1	40,500	....	148,000
22	2·10	12,000	0·60	6,900	0·4	6,400	2·4	13,200	8·7	43,800	....	145,000
23	2·0	11,600	0·60	6,900	0·4	6,400	2·6	14,100	9·1	45,900	....	142,000
24	2·0	11,600	0·55	6,750	0·4	6,400	2·9	15,300	9·9	50,200	....	139,000
25	2·0	11,600	0·55	6,750	0·4	6,400	3·2	16,600	10·6	54,000	....	136,000
26	2·0	11,600	0·55	6,750	0·4	6,400	3·8	19,300	11·2	57,300	....	133,000
27	2·0	11,600	0·50	6,600	0·4	6,400	4·1	20,700	12·3	63,300	....	130,000
28	1·95	11,400	0·50	6,600	0·4	6,400	4·4	22,100	13·4	69,400	....	127,000
29	1·95	11,400	....	....	0·4	6,400	4·6	23,100	14·9	77,600	....	124,000
30	1·95	11,400	....	....	0·4	6,400	4·8	24,000	15·7	82,500	....	124,000
31	1·90	11,200	....	....	0·3	6,200	....	....	16·9	88,800	....	....

Daily Gauge Heights and Discharges of Columbia River for Castlegar, B. C., for 1913.—*Continued.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft	Feet.	Sec.-ft.
1	22·6	123,000	16·9	88,800	12·1	62,200	8·2	41,100	5·1	25,500	2·9	15,300
2	22·4	122,000	16·8	88,800	12·3	63,300	7·9	39,500	5·0	25,000	2·9	15,300
3	22·0	119,000	16·8	88,300	12·5	64,400	7·8	39,000	4·9	24,500	2·9	15,300
4	21·8	118,000	16·8	88,300	12·7	65,500	7·6	38,000	4·8	24,000	2·9	15,300
5	21·4	115,000	16·7	87,700	13·0	67,200	7·4	37,000	4·7	23,500	2·9	15,300
6	21·0	113,000	16·7	87,700	13·2	68,300	7·2	36,000	4·7	23,500	2·8	14,900
7	20·6	111,000	16·7	87,700	13·3	68,800	7·0	35,000	4·6	23,100	2·8	14,900
8	20·4	110,000	16·8	88,300	13·2	68,300	6·9	34,500	4·5	22,600	2·8	14,900
9	20·4	110,000	16·8	88,300	13·1	67,700	6·7	33,500	4·3	21,600	2·7	14,500
10	20·2	108,000	16·8	88,300	12·9	66,600	6·5	32,500	4·2	21,200	2·7	14,500
11	19·9	106,000	16·8	88,300	12·7	65,500	6·4	32,000	4·0	20,200	2·7	14,500
12	19·8	106,000	16·6	87,200	12·4	63,900	6·3	31,500	4·0	20,200	2·5	13,700
13	19·6	105,000	16·4	86,100	12·[illegible]	62,800	6·1	30,500	4·0	20,200	2·5	13,700
14	19·0	101,000	16·4	86,100	12·0	61,700	6·0	30,000	4·0	20,200	2·4	13,200
15	18·8	99,800	16·0	83,800	11·8	60,600	5·9	29,500	3·9	19,700	2·3	12,800
16	18·4	97,500	15·7	82,100	11·6	59,500	5·8	29,000	3·9	19,700	2·3	12,800
17	17·6	92,900	15·4	80,500	11·2	57,300	5·8	29,000	3·8	19,300	2·2	12,400
18	17·3	91,100	15·2	79,300	10·6	54,000	5·8	29,000	3·8	19,300	2·1	12,000
19	17·0	89,400	14·8	77,100	10·0	50,800	5·7	28,500	3·8	19,300	2·1	12,000
20	16·7	87,700	14·4	74,900	9·8	49,700	5·7	28,500	3·7	18,800	2·0	11,600
21	16·4	86,100	14·0	72,700	9·7	49,100	5·6	28,000	3·5	18,000	2·0	11,600
22	16·4	86,100	13·6	70,500	9·7	49,100	5·6	28,000	3·4	17,500	1·9	11,200
23	16·6	87,200	13·3	68,800	9·5	48,100	5·5	27,500	3·4	17,500	1·8	10,800
24	17·0	89,400	13·1	67,700	9·3	47,000	5·4	27,000	3·3	17,100	1·7	10,400
25	17·3	91,100	12·8	66,100	9·1	45,900	5·4	27,000	3·25	16,800	1·6	10,000
26	17·5	92,300	12·8	66,100	9·1	45,900	5·4	27,000	3·2	16,600	1·6	10,000
27	17·6	92,900	12·8	66,100	9·0	45,400	5·3	26,500	3·1	16,200	1·6	10,000
28	17·7	93,400	12·6	65,000	8·6	43,200	5·2	26,000	3·1	16,200	1·6	10,000
29	17·7	93,400	12·6	65,000	8·7	43,800	5·2	26,000	3·1	16,200	1·5	9,600
30	17·5	92,300	12·5	64,400	8·5	42,700	5·2	26,000	3·0	15,800	1·4	9,200
31	17·3	91,100	12·3	63,300	....	....	5·1	25,500	....	....	1·4	9,200

COLUMBIA RIVER NEAR TRAIL, ROSSLAND PRECINCT, NELSON WATER DISTRICT.

Location.—Fifteen miles above international boundary, above mouth of Pend d' Oreille river, below mouth of Kootenay at the highway bridge near Trail, B.C.

Records Available.—May to December, 1913.

Winter Conditions.—Fairly heavy snowfall. No continuous cold weather, though for a day or two the thermometer may reach (–15° F.) The river never freezes over.

Gauge.—Gauge painted on bridge pier was used till June, when it was abandoned and a chain gauge was installed. Mr. C. A. Brodwick, of Trail, B.C., reads the gauge daily.

Channel.—The river winds from the left (looking downstream) about 100 yards above the bridge; below the river is straight for 400 yards; the control, a pronounced riffle 100 yards below the bridge, appears permanent.

Discharge Measurements.—Measurements are made from the upstream side of the traffic bridge. Thirteen well distributed measurements have been made.

Accuracy.—Accurate gauge readings have been obtained. Reliable measurements were made throughout the year. The gauge-height-discharge curve appears to be very good. The results should be within 5 per cent.

General.—The station on the Columbia river at Trail was established in 1912 under the direction of Mr. Gray Donald. During 1913 it was maintained conjointly by the British Columbia Hydrographic Surveys and the provincial district engineer, Water Rights Branch, Nelson. Conditions appear permanent at this station, and satisfactory results should be obtained.

This station is very important. It is the chief factor from which the discharge of the Columbia into the United States may be obtained. Pend d' Oreille river is the only tributary of any consequence between this station and the International boundary.

The sum of the discharges of the Columbia at Trail, and the Pend d' Oreille should give the discharge of the Columbia into the United States to within 1 per cent. No gauging station has been established on the Columbia in the United States near the boundary, and it is not probable that any can be established without a large outlay, above Kettle Falls. The discharge at the international boundary does not appear to be more than 5 per cent less than the discharge at the Kettle Falls where, it may here be added, is the possible site of a large power development.

The drainage area of the Columbia at Trail is about 34,000 square miles. Below Arrow Lakes, some 25 miles above this station, the Columbia river never freezes, while above the lakes, ice conditions exist for generally four months in the year. The whole drainage area above this station is a very mountaionus country, with heavy snowfall. The tributaries of the Columbia are generally glacial fed, and any year may see extremely high water, if in June we have a series of hot days and nights. The variation between maximum and minimum flow is great. In 1913 the maximum recorded discharge was 297,000 c.f.s., and the minimum recorded discharge was in March, when it was as low as 1,4000 c.f.s.

Discharge Measurements of Columbia river near Trail, B.C., for 1912-13.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1912.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Dec. 18......	Wilson..........................	....	480	6,640	2·79	10·50	18,600
1913.							
Nov. 5......	Wilson..........................	....	460	5,640	2·53	8·50	14,300
Mar. 26......	Wilson..........................	....	460	5,640	2·72	8·50	[1]15,400
May 1......	C. E. R. & Biker............	1,048	515	9,360	6·30	15·40	58,700
May 21......	Biker & Lowley..............	1,527	532	11,200	7·30	19·00	[2]82,200
June 11......	C. E. R. Biker and party....	1,048	687	23,900	12·40	40·20	297,000
July 4......	Lowley & Venables..........	1,527	663	20,100	10·90	34·50	219,000
July 21......	do do	1,527	580	15,800	9·63	27·60	152,000
Aug. 6......	do do	1,527	583	15,100	9·42	26·10	142,000
" 7......	C. E. R. & J. A. E...........	1,048	583	15,100	9·65	26·10	145,000
Sept. 4......	Lowley & Venables..........	1,527	547	12,300	7·93	21·00	97,000
Nov. 5......	C. E. R. & C. E. W..........	1,048	509	7,630	4·86	13·10	37,100
1914.							
Jan. 15......	Venables & Webb............	1,048	485	6,250	3·57	9·50	[3]22,300

Note.—[1]Strong wind downstream.
[2]Not a reliable measurement.
[3]New gauge was established August 7, when both gauges read 26′ 10″. On November 5 old gauge read 12′ 6″ while new gauge read 13′ 6″. Difference caused by water piling up beside pier to which old gauge was fastened, during high water.

Monthly Discharge of Columbia river near Trail, B.C., for 1913.

(Drainage area, 84,000 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May	165,000	56,800	86,400	2·54	2·93	5,310,000
June	312,000	191,000	262,000	7·70	8·59	15,600,000
July	236,000	150,000	181,000	5·32	6·13	11,100,000
August	152,000	98,400	125,000	3·68	4·24	7,690,000
September	98,400	62,100	83,500	2·46	2·75	4,970,000
October	60,500	39,300	46,900	1·38	1·59	2,880,000
November	39,300	27,800	32,200	0·95	1·06	1,920,000
December	27,800	18,600	22,600	0·66	0·76	1,390,000

Note.—Columbia river near Trail is immediately below the mouth of the Kootenay.

Daily Gauge Heights and Discharges of Columbia river near Trail for 1913.

Day.	April.		May.		June.	
	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	....	16·2	58,200	31·5	191,000
2	....	....	16·1	57,500	32·6	202,000
3	....	....	16·1	57,500	33·7	214,000
4	....	....	16·1	57,500	34·8	226,000
5	....	....	16·0	56,800	35·9	239,000
6	....	....	16·0	56,800	36·7	248,000
7	....	....	16·0	56,800	37·5	258,000
8	....	....	16·2	58,200	37·5	258,000
9	....	....	16·6	61,300	37·3	256,000
10	....	....	16·9	63,700	39·2	279,000
11	....	....	17·2	66,000	40·0	290,000
12	....	....	17·5	68,300	40·4	295,000
13	....	....	17·9	71,400	41·3	308,000
14	....	....	18·1	73,000	41·6	312,000
15	....	....	18·5	76,000	41·6	312,000
16	....	....	18·7	77,600	41·2	306,000
17	....	....	19·3	82,400	40·6	298,000
18	11·8	28,800	19·7	85,600	40·1	291,000
19	12·0	30,000	19·8	86,400	39·4	282,000
20	12·1	30,600	19·9	87,200	38·8	274,000
21	12·5	33,000	20·0	88,000	38·2	266,000
22	13·0	36,000	20·2	89,600	37·6	259,000
23	14·1	43,500	20·6	92,800	37·1	253,000
24	14·1	43,500	21·2	97,600	37·0	252,000
25	14·4	45,600	22·3	16,670	36·8	250,000
26	14·8	48,400	23·4	116,600	36·8	250,000
27	15·2	51,200	24·5	126,500	36·6	247,000
28	15·5	53,300	25·8	137,400	36·5	246,000
29	15·7	54,700	26·8	146,200	36·3	244,000
30	16·0	56,800	27·7	154,300	36·1	241,000
31	....	....	28·9	165,100	....	....

DAILY GAUGE HEIGHTS AND DISCHARGES of Columbia river near Trail for 1913. —*Continued.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	35·7	236,000	27·5	152,500	21·2	97,600	16·5	60,500	13·5	39,300	11·6	27,800
2	35·3	232,000	27·2	149,800	21·1	96,800	16·4	59,700	13·4	38,600	11·5	27,500
3	34·9	227,000	26·9	147,100	21·1	96,800	16·1	57,500	13·2	37,200	11·4	26,800
4	34·5	222,200	26·6	144,400	21·0	96,000	15·9	56,100	13·2	37,200	11·3	26,300
5	34·0	217,000	26·3	141,700	21·0	96,000	15·7	54,700	13·1	36,600	11·3	26,300
6	33·6	213,000	26·0	139,000	21·2	97,600	15·5	53,300	13·0	36,000	11·3	26,300
7	32·8	204,000	26·1	139,900	21·3	98,400	15·4	52,600	13·0	36,000	11·2	25,800
8	32·4	200,000	26·1	139,900	21·3	98,400	15·2	51,200	12·9	35,400	11·1	25,300
9	32·0	196,000	26·0	139,000	21·4	98,400	15·0	49,800	12·8	34,800	11·0	24,800
10	31·7	193,000	25·9	138,200	21·2	97,600	14·8	48,400	12·8	34,800	10·9	24,300
11	31·6	192,000	25·8	137,400	21·1	96,800	14·7	47,700	12·7	34,200	10·8	23,800
12	31·5	191,000	25·8	137,400	20·8	94,400	14·6	47,000	12·7	34,200	10·7	23,300
13	31·3	189,000	25·7	136,600	20·4	91,200	14·5	46,300	12·6	33,600	10·6	22,800
14	30·8	184,000	25·5	135,000	20·1	88,800	14·3	44,900	12·4	32,400	10·5	22,300
15	30·3	179,000	25·2	132,600	19·8	86,400	14·2	44,200	12·3	31,800	10·4	21,800
16	29·8	174,000	25·0	131,000	19·4	83,200	14·1	43,500	12·2	31,200	10·4	21,800
17	29·4	170,000	24·8	129,200	19·0	80,000	14·8	48,400	12·0	30,000	10·4	21,800
18	28·8	164,200	24·4	125,600	18·9	79,200	14·4	45,600	11·9	24,400	10·3	21,300
19	28·4	160,600	23·9	121,100	18·7	77,600	14·3	44,900	11·8	28,800	10·3	21,300
20	28·0	157,000	23·4	116,600	18·5	76,000	14·2	44,200	11·7	28,300	10·2	20,900
21	27·6	153,400	22·8	111,200	18·3	74,500	14·1	43,500	11·6	27,800	10·2	20,900
22	27·2	149,800	22·7	110,300	18·2	73,700	14·0	42,800	11·7	28,300	10·2	20,900
23	27·2	149,800	22·3	106,700	18·0	72,200	14·0	42,800	11·8	28,800	10·1	20,400
24	27·7	154,300	21·8	102,400	17·7	69,800	13·9	42,100	11·8	28,800	10·1	20,400
25	27·9	156,100	21·6	100,800	17·4	67,500	13·8	41,400	11·8	28,800	10·0	20,000
26	28·3	159,700	21·6	100,800	17·3	66,800	13·8	41,400	11·8	28,800	10·0	20,000
27	28·6	162,400	21·4	99,200	17·1	65,300	13·7	40,700	11·8	28,800	9·9	19,500
28	28·5	161,500	21·5	100,000	16·9	63,700	13·7	40,700	11·7	28,300	9·9	19,500
29	28·2	158,800	21·5	100,000	16·8	62,900	13·6	40,000	11·7	28,300	9·8	19,000
30	27·8	155,200	21·5	100,000	16·7	62,100	13·6	40,000	11·7	28,300	9·8	19,000
31	27·6	153,400	21·3	98,400	....	....	13·5	39,300	....	....	9·7	18,600

HORSETHIEF CREEK.

Location.—On the east slope of the Selkirk mountains, on the traffic bridge 4 miles from Wilmer and 1 mile from the mouth.

Records Available.—June to October, 1912; May to September, 1913; Ice measurement on November 27, 1913; discharge, 147.

Gauge.—Vertical staff gauge referred to three bench-marks, nailed to one bridge abutment. Capt. Ch. de Crespigny reads the gauge three times a week.

Channel.—The measuring section is not a desirable one. The control does not appear permanent, and there may be a backwater effect from the Columbia. Accurate measurements may not be obtained.

Discharge Measurements.—Meterings are taken from the bridge, four measurements were made in 1912, and nine in 1913.

Accuracy.—The gauge readings are infrequent, the discharge measurements unreliable, and the gauge-height-discharge curves for 1912-13 do not appear satisfactory, nor do they agree. Accuracy not guaranteed to within 25 per cent.

Discharge Measurements of Horsethief Creek, near Wilmer, B.C., for 1912-13

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge
1912.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
May 29......	H. C. Hughes................	1055	68	129	3·75	1·70	484
June 13......	do	1055	97	222	5·31	2·00	1,180
July 3......	do	1055	95	226	5·19	1·90	1,170
Sept. 28......	C. E. Richardson............	1055	61	119	2·12	1·22	252
1913.							
May. 16......	C. E. R. & J. A. E............	1672	60	134	2·00	1·20	271
June 2......	C. E. Richardson............	1048	87	268	8·00	2·65	2,140
June 19......	J. A. Elliott..................	1672	85	220	6·42	2·22	1,410
July 11......	C. E. Richardson............	1048	85	225	6·66	2·25	1,500
July 25......	J. A. Elliott..................	1672	85	253	8·60	2·50	2,180
July 30......	do	1672	83	200	5·67	2·00	1,130
Sept. 3......	C. E. Richardson and R. G. Swan......................	1048	82	200	4·25	1·95	850
Sept. 13......	J. A. Elliott..................	1672	77	186	4·12	1·88	770
Nov. 27......	C. E. Webb..................	1048	55	98	1·50	....	[1]147

Note.—[1]Gauge frozen in.

Monthly Discharge of Horsethief Creek at Mouth for 1913.

(Drainage area, 170 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage. area.	Total in acre-feet.
May..	2,380	250	612	3·60	4·15	37,600
June..	2,930	1,220	1,948	11·50	12·83	116,000
July..	3,200	880	1,494	8·79	10·13	91,600
August..	2,120	880	1,400	8·24	9·50	86,100
September..	1,640	610	901	5·30	5·91	53,600

Daily Gauge Heights and Discharges of Horsethief Creek near Wilmer, B.C., for 1913.

(Drainage Area 170 square miles.)

Day.	May.		June.		July.		August.		September.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
1	Mean G.H. for 15 days=1·00	Discharge for 15 days=2,625	2·6	2,380	2·2	1,410	2·1	1,220	2·1	1,220
2			2·6	2,380	2·2	1,410	2·2	1,410	2·0	1,030
3			2·6	2,380	2·1	1,220	2·3	1,640	2·0	1,030
4			2·6	2,380	2·1	1,220	2·5	2,120	2·2	1,410
5			2·6	2,380	2·0	1,030	2·4	1,880	2·3	1,640
6			2·6	2,380	2·2	1,410	2·3	1,640	2·2	1,410
7			2·6	2,380	2·4	1,880	2·3	1,640	2·1	1,220
8			2·7	2,650	2·2	1,410	2·2	1,410	1·9	880
9			2·8	2,930	2·2	1,410	2·2	1,410	1·8	730
10			2·7	2,650	2·2	1,410	2·2	1,410	1·8	730
11			2·6	2,380	2·2	1,410	2·3	1,640	1·8	730
12			2·6	2,380	2·1	1,220	2·3	1,640	1·9	880
13			2·5	2,120	2·0	1,030	2·3	1,640	1·9	880
14			2·5	2,120	2·0	1,030	2·2	1,410	1·9	880
15			2·4	1,880	1·9	880	2·2	1,410	1·9	880
16	1·2	250	2·4	1,880	1·9	880	2·2	1,410	1·9	880
17	1·2	250	2·3	1,640	1·9	880	2·0	1,030	1·9	880
18	1·2	250	2·3	1,640	2·0	1,030	1·9	880	1·9	880
19	1·2	250	2·2	1,410	2·1	1,220	1·9	880	1·9	880
20	1·3	295	2·2	1,410	2·2	1,410	2·0	1,030	1·9	880
21	1·4	355	2·2	1,410	2·3	1,640	2·2	1,410	1·9	880
22	1·5	425	2·1	1,220	2·4	1,880	2·0	1,030	1·8	730
23	1·7	610	2·1	1,220	2·5	2,120	2·1	1,220	1·8	730
24	1·9	880	2·1	1,220	2·7	2,650	2·2	1,410	1·8	730
25	2·1	1,220	2·2	1,410	2·9	3,200	2·2	1,410	1·8	730
26	2·2	1,410	2·3	1,640	2·5	2,120	2·2	1,410	1·8	730
27	2·3	1,640	2·3	1,640	2·5	2,120	2·2	1,410	1·8	730
28	2·4	1,880	2·3	1,640	2·4	1,880	2·2	1,410	1·7	610
29	2·4	1,880	2·3	1,640	2·3	1,640	2·2	1,410	1·7	610
30	2·6	2,380	2·3	1,640	2·1	1,220	2·1	1,220	1·7	610
31	2·6	2,380	....	....	2·0	1,030	2·1	1,220	....	....

ILLECILLEWAET RIVER NEAR REVELSTOKE, B.C.

Location.—This station is located within 1 mile of the city of Revelstoke, and 1 mile from the mouth of the river; the gauge is located on traffic bridge in S.W. ¼ section 26, township 23, range 2, west 6th meridian; the measuring section is located on traffic bridge in N.E. ¼ section 22, township 23, range 2, west 6th meridian.

Records Available.—October to December, 1911; May to December, 1912; April to November, 1913. Measurement made under ice conditions in February, 1912, gave a discharge of 197 c.f.s.

Gauge.—A chain gauge, referred to two bench-marks, is used and read by Miss S. Moran of Revelstoke.

Channel.—The measuring section is one-half mile below gauge. The section at the gauge is very fast in high water, and at the measuring section there is a possibility of backwater from the Columbia during high water, the control at the gauge appears permanent.

Discharge Measurements.—Eight well distributed measurements were made during 1911-12, and five were made in 1913.

Accuracy.—The gauge readings are accurate, and the stream is closely watched by an observer. The discharge measurements should be good, but the gauge-height-discharge curve is not first-class. Accuracy not guaranteed to greater degree than 10 per cent.

Winter Conditions—See Columbia river near Revelstoke.

Discharge Measurements of Illecillewaet River near Revelstoke for 1911-12-13.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1911.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Oct. 13	C. E. Richardson	1,048	140	478	1·40	1·32	[1]669·0
1912.							
Feb. 24	do	1047	129	221	0·89	0·70	197
June 20	do	1048	144	890	7·43	6·60	6,610
June 24	do	1048	145	962	7·80	6·90	7,510
July 3	do	1048	142	735	5·57	5·60	4,100
Aug. 20	do	1048	133	583	3·98	4·40	2,320
Sept. 14	do	1048	128	514	3·40	3·82	1,750
Oct. 4	do	1055	128	498	2·16	3·00	1,080
1913.							
May 5	J. A. Elliott	1048	128	327	3·40	3·00	[2]1,110
May 26	do	1048	134	636	8·00	6·11	5,030
June 11	do	1672	145	878	6·92	6·55	6,080
Sept. 17	R. G. Swan	1048	101	660	3·36	3·90	[3]2,220
Nov. 22	C. E. Webb	1048	130	431	1·41	2·35	607

[1]Gauge abandoned.
[2]Slightly different section.
[3]Different section.

Monthly Discharge of Illecillewaet River near Revelstoke for 1913.

(Drainage area, 480 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
April	2,110	300	1,190	2·5	2·79	70,800
May	6,560	934	2,845	5·9	6·80	175,000
June	11,880	3,740	6,173	12·8	14·28	364,000
July	10,300	3,310	5,134	10·7	12·34	316,000
August	8,970	1,890	3,803	7·9	9·11	234,000
September	11,800	1,240	2,302	4·8	5·36	137,000
October	1,590	606	1,094	2·3	2·65	67,000
November	1,010	606	748	1·6	1·79	44,500

DAILY GAUGE HEIGHTS AND DISCHARGES of Illecillewaet River near Revelstoke for 1913.

Day.	April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	....	3·0	1,080	6·7	6,560
2	....	....	3·0	1,080	6·9	7,340
3	....	....	2·9	1,010	7·0	7,800
4	....	....	2·9	1,010	6·8	6,920
5	....	....	2·8	934	6·4	5,700
6	1·7	347	2·8	934	6·3	5,450
7	1·7	347	2·8	934	6·5	5,950
8	1·5	300	3·4	1,410	7·0	7,800
9	1·9	410	3·8	1,790	7·6	11,800
10	1·9	410	4·6	2,670	7·7	11,880
11	2·1	497	4·6	2,670	7·0	7,800
12	2·6	796	4·6	2,670	7·0	7,800
13	3·0	1,080	4·5	2,550	7·1	8,410
14	3·3	1,320	4·5	2,550	6·8	6,920
15	3·3	1,320	4·4	2,440	6·1	5,010
16	3·4	1,410	4·2	2,220	5·8	4,410
17	3·3	1,320	4·1	2,110	5·5	3,900
18	3·5	1,500	4·0	2,000	5·4	3,740
19	3·9	1,890	4·0	2,000	6·0	4,800
20	3·9	1,890	4·0	2,000	6·8	6,920
21	4·1	2,110	4·4	2,440	6·3	5,450
22	4·0	2,000	4·6	2,670	6·0	4,800
23	3·8	1,790	5·6	4,060	6·0	4,800
24	3·4	1,410	5·7	4,234	5·9	4,600
25	3·3	1,320	5·9	4,600	5·8	4,410
26	3·3	1,320	6·2	5,220	6·0	4,800
27	3·3	1,320	6·2	5,220	6·0	4,800
28	3·2	1,240	6·6	6,230	6·0	4,800
29	3·2	1,240	6·2	5,220	6·0	4,800
30	3·1	1,160	6·4	5,700	6·1	5,010
31	....	....	6·7	6,560	....	....

DAILY GAUGE HEIGHTS AND DISCHARGES of Illecillewaet River near Revelstoke for 1913.—*Continued.*

Day.	July.		August.		September.		October.		November.	
	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	6·6	6,230	5·9	4,600	3·8	1,790	3·2	1,240	2·9	1,010
2	6·6	6,230	6·1	5,010	4·5	2,550	3·6	1,590	2·9	1,010
3	5·6	4,060	6·2	5,220	4·5	2,550	3·2	1,240	2·9	1,010
4	5·5	3,900	5·9	4,600	7·6	11,800	3·1	1,160	2·9	1,010
5	5·6	4,060	6·0	4,800	5·8	4,410	3·0	1,080	2·7	864
6	6·6	6,230	6·1	5,010	4·5	2,550	2·8	934	2·7	864
7	6·8	6,920	6·5	5,950	4·3	2,330	2·8	934	2·6	796
8	6·0	4,800	7·2	8,970	4·3	2,330	2·8	934	2·5	730
9	6·7	6,560	5·8	4,410	4·3	2,330	2·8	934	2·4	667
10	6·5	5,950	5·6	4,060	3·9	1,890	2·5	730	2·4	667
11	6·2	5,220	5·8	4,410	3·8	1,790	2·3	606	2·4	667
12	5·4	3,740	5·7	4,234	4·0	2,000	2·6	796	2·4	667
13	5·4	3,740	5·7	4,234	4·6	2,670	3·5	1,500	2·4	667
14	7·4	10,300	5·4	3,740	4·1	2,110	3·6	1,590	2·4	667
15	6·5	5,950	4·8	2,910	3·9	1,890	3·3	1,320	2·4	667
16	5·7	4,234	4·4	2,440	3·9	1,890	3·1	1,160	2·4	667
17	5·2	3,450	4·8	2,910	3·8	1,790	3·0	1,080	2·4	667
18	5·3	3,590	4·6	2,670	4·3	2,330	2·9	1,010	2·4	667
19	5·7	4,234	4·3	2,330	4·0	2,000	2·9	1,010	2·4	667
20	6·4	5,700	4·0	2,000	3·6	1,590	2·9	1,010	2·3	606
21	6·5	5,950	4·0	2,000	3·6	1,590	3·0	1,080	2·3	606
22	6·6	6,230	4·4	2,440	3·5	1,500	2·8	934	2·3	606
23	6·2	5,220	4·7	2,790	3·5	1,500	3·0	1,080	....	....
24	6·5	5,950	5·0	3,170	3·5	1,500	2·9	1,010	....	....
25	6·4	5,700	4·8	2,710	3·2	1,240	3·2	1,240	....	....
26	6·2	5,220	5·7	4,234	3·3	1,320	3·1	1,160	....	....
27	5·9	4,600	5·7	4,234	3·4	1,410	3·1	1,160	....	....
28	6·0	4,800	5·2	3,450	3·5	1,500	3·1	1,160	....	....
29	5·1	3,310	5·0	3,170	3·5	1,500	3·0	1,080	....	....
30	5·2	3,450	5·1	3,310	3·4	1,410	3·0	1,080	....	....
31	5·5	3,900	3·9	1,890	....	....	3·0	1,080	....	....

ILLECILLEWAET RIVER AT GLACIER.

Location.—In township 26, range 26, west 5th meridian, at the foot-bridge immediately above the railway bridge, 200 yards from C.P.R. hotel, Glacier.

Records Available.—June to December, 1913.

Winter Conditions.—Severe (–40° F.) with very heavy snowfall—between 40 and 50 feet. Gauge readings are generally affected by ice conditions from November to April.

Gauge.—A vertical staff gauge is used and read by H. T. Hillyer, Glacier, B.C.

Channel.—The bed is rocky and during freshet the water is very swift, the control appears permanent.

Discharge Measurements.—Twelve well distributed measurements were made during 1913.

Accuracy.—Accurate measurements were not obtained. The river is very flashy and the gauge readings obtained cannot be guaranteed to be the mean for the day. Accuracy 20 per cent.

General.—This station on the Illecillewaet is only 2½ miles from the tongue of the Illecillewaet or Great Glacier. The C.P.R. have a small power plant immediately above the station from which they light their hotel during the summer. In extremely cold weather the stream probably drops to 10 c.f.s.

Discharge Measurements of Illecillewaet River near Glacier for 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
May 23	C. E. R.	1,048	35	22·0	3·90	0·98	85·8
June 4	do	1,048	37	55·4	5·70	1·80	316·0
June 5	do	1,048	37	39·0	4·80	1·40	187·0
June 13	J. A. E.	1,672	37	63·6	6·77	2·00	430·0
July 6	do	1,672	37	67·7	7·20	2·10	487·0
July 20	do	1,672	37	92·0	8·54	2·70	786·0
July 21	do	1,672	37	74·0	7·64	2·25	565·0
July 23	C. E. R.	1,048	37	92·0	7·77	2·70	715·0
July 23	do	1,048	37	100·0	8·43	2·90	843·0
Aug. 11	do	1,048	37	65·1	5·70	1·95	351·0
Sept. 10	R. G. S. & C. E. R.	1,048	37	33·8	2·56	0·68	86·4
Dec. 2	C. E. W.	1,048	34	18·8	1·30	0·20	25·1

Daily Gauge Heights and Discharges of Illecillewaet River near Glacier for 1913.

Month.	Discharge in Second-Feet.		
	Maximum.	Minimum.	Mean.
June	650	125	329
July	950	125	483
August	900	90	530
September	325	30	79
October	35	20	27
November	20	15	16
December	25	15	16

Daily Gauge Heights and Discharges of Illecillewaet River near Glacier for 1913.

Day.	May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	....	1·8	325
2	....	....	2·0	410
3	....	....	2·0	410
4	....	....	1·9	365
5	....	....	1·6	245
6	....	....	1·7	285
7	....	....	2·0	410
8	....	....	2·5	650
9	....	....	2·5	650
10	....	....	2·2	500
11	....	....	2·0	410
12	....	....	2·1	455
13	....	....	2·0	410
14	....	....	1·5	215
15	....	....	1·3	165
16	....	....	1·2	145
17	....	....	1·1	125
18	....	....	1·7	285
19	....	....	2·5	650
20	....	....	1·8	325
21	....	....	1·5	215
22	....	....	1·7	285
23	1·0	105	1·7	285
24	1·0	105	1·5	215
25	1·2	145	1·5	215
26	1·4	190	1·5	215
27	1·4	190	1·4	195
28	1·4	190	1·6	245
29	1·3	165	1·6	245
30	1·3	165	1·8	325
31	1·7	285	....	....

DAILY GAUGE HEIGHTS AND DISCHARGES of Illecillewaet River near Glacier for 1913.—*Continued.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	2·0	410	2·9	850	1·0	105	0·4	35	0·1	20	0·1	20
2	1·7	285	2·9	850	0·9	90	6·4	35	0·1	20	0·2	25
3	1·6	245	2·9	850	1·8	375	0·3	30	0·1	20	0·2	25
4	1·6	245	2·9	850	1·5	215	0·3	30	0·0	15	0·1	20
5	1·8	325	3·0	900	0·9	90	0·3	30	0·0	15	0·0	15
6	2·1	455	2·6	700	0·8	75	0·3	30	0·0	15	0·0	15
7	2·2	500	2·7	750	0·8	75	0·3	30	0·0	15	0·0	15
8	2·2	500	2·3	550	0·8	75	0·2	25	0·0	15	0·0	15
9	2·0	410	2·3	550	0·6	55	0·2	25	0·0	15	0·0	15
10	2·4	410	2·6	700	0·7	65	0·2	25	0·0	15	0·0	15
11	1·7	285	2·5	650	0·7	65	0·4	35	0·0	15	0·0	15
12	1·7	285	2·7	750	0·8	75	0·5	30	0·0	15	0·0	15
13	1·7	285	2·5	650	1·0	105	0·3	30	0·0	15	0·0	15
14	1·1	125	1·5	215	0·9	90	0·2	25	0·0	15	0·0	15
15	1·2	145	1·3	165	0·8	75	0·2	25	0·0	15	0·0	15
16	1·1	125	1·3	165	0·8	75	0·2	25	0·0	15	0·0	15
17	1·4	190	1·2	145	1·0	105	0·2	25	0·0	15	0·2	15
18	1·8	325	0·9	90	0·9	90	0·2	25	0·0	15	0·0	15
19	2·4	600	0·9	90	0·8	75	0·2	25	0·0	15	0·0	15
20	2·9	850	1·4	190	0·8	75	0·2	25	0·0	15	0·0	15
21	3·0	900	1·4	190	0·8	75	0·2	25	0·0	15	0·0	15
22	3·1	950	2·3	550	0·4	35	0·2	25	0·0	15	0·0	15
23	3·0	900	2·6	700	0·4	35	0·2	25	0·0	15	0·0	15
24	3·0	900	2·6	700	0·4	35	0·2	25	0·0	15	0·0	15
25	2·8	800	2·5	550	0·3	30	0·2	25	0·0	15	0·0	15
26	2·8	800	2·3	550	0·3	30	0·2	25	0·0	15	0·0	15
27	2·7	750	2·3	550	0·3	30	0·2	25	0·0	15	0·0	15
28	2·4	600	2·3	550	0·4	35	0·2	25	0·0	15	0·0	15
29	1·8	325	2·2	500	0·4	35	0·1	20	0·0	15	0·0	15
30	1·4	190	2·2	500	0·4	35	0·1	20	0·1	20	0·0	15
31	2·9	850	1·8	325	....	....	0·1	20	....	....	0·0	15

Kicking Horse River looking upstream from Natural Bridge.

KICKING HORSE RIVER NEAR GOLDEN.

Location.—In N.E. ¼ section 12, township 27, range 22, west 5th meridian, on traffic bridge in the town of Golden.

Records Available.—April to October, 1912; April to November, 1913. One metering was taken under ice conditions in February, 1912; discharge, 172 c.f.s.

One metering was taken under ice conditions in February, 1914; discharge 276 c.f.s.

Winter Conditions.—Severe (–40° F.), with heavy snowfall. Ice conditions generally exist from November to April. Frazil ice.

Gauge.—A vertical staff gauge is used and read two or three times daily by Mr. W. Wenman of Golden, B.C.

Channel.—Straight for 200 yards above and below the station. Control is a sandbar about 100 yards downstream from section.

Discharge Measurements.—Measurements are made from bridge, ten being made in 1911-12, and five in 1913.

Accuracy.—Gauge readings are very accurate, the gauge being read as many as six times a day during high water. Measurements appear accurate and gauge-height-discharge curves are very good. Results guaranteed to be within 5 per cent, except in May and June, when there may be an error of 15 per cent.

Discharge Measurements of Kicking Horse River near Golden for 1911-12-13.

Date.	Hydrographer.	Meter No.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
1911.							
Oct. 18	C. E. Richardson	1,048	103	279	1·66	1·72	464
1912.							
Feb. 22	do	1,048	80	185	0·93	....	172[1]
May 24	H. C. Hughes	1,055	119	430	4·28	3·46	1,840
June 4	do	1,055	110	372	2·68	2·64	999
June 8	do	1,048	155	567	4·21	3·90	2,390[2]
June 24	do	1,055	205	928	6·42	5·58	5,970[2]
July 12	do	1,055	185	654	5·19	4·62	3,340[2]
July 26	do	1,055	180	604	4·69	4·26	2,830[2]
Sept. 26	do	1,055	110	363	2·85	2·48	1,035
Oct. 1	do	1,055	110	351	2·65	2·36	930
1913.							
May 22	J. A. Elliott	1,672	112	431	3·67	2·97	1,540
July 5	do	1,048	185	654	5·60	4·52	3,660
July 5	do	1,672	185	654	5·50	4·52	3,580
Sept. 4	R. G. Swan	1,048	186	712	6·47	4·90	4,610
Nov. 29	C. E. Webb	1,048	96	277	1·40	1·55	384

[1] Ice Conditions.
[2] Water flowing inside channel.

Monthly Discharge of Kicking Horse River near Golden for 1913.

(Drainage area, 700 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
April	1,260	650	836	1·20	1·34	49,700
May	6,320	416	1,817	2·60	3·00	111,000
June	9,580	3,390	2,762	4·00	4·46	164,000
July	5,660	2,500	4,018	5·70	6·57	246,000
August	4,760	2,250	3,426	4·90	5·65	210,000
September	4,240	1,420	2,056	2·90	3·24	122,000
October	1,420	650	939	1·30	1·50	57,700
November	730	181	493	0·70	0·78	29,400

Daily Gauge Heights and Discharges of Kicking Horse River near Golden for 1913.

Day.	April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	....	1·8	571	5·7	7,040
2	....	....	1·7	483	5·8	7,420
3	....	....	1·7	483	5·8	7,420
4	....	....	1·7	483	5·7	7,040
5	....	....	1·6	416	5·7	7,040
6	....	....	1·6	416	5·4	5,980
7	....	....	1·7	483	5·5	6,320
8	....	....	1·7	483	6·0	8,240
9	....	....	1·7	483	6·3	9,580
10	....	....	2·2	895	6·3	9,580
11	....	....	2·3	979	6·2	9,120
12	....	....	2·3	979	6·1	8,670
13	....	....	2·4	1,060	5·8	7,420
14	....	....	2·4	1,060	5·7	7,040
15	1·9	650	2·4	1,060	5·2	5,350
16	2·1	812	2·3	979	4·7	4,000
17	2·3	979	2·4	1,060	4·5	3,580
18	2·1	812	2·3	979	4·4	3,390
19	2·2	895	2·4	1,060	4·9	4,490
20	2·5	1,150	2·6	1,240	6·0	8,240
21	2·6	1,260	2·7	1,330	5·5	6,320
22	2·4	1,060	3·0	1,600	5·1	5,050
23	2·1	812	3·5	2,130	5·1	5,050
24	2·1	812	3·7	2,370	4·9	4,490
25	2·1	812	4·1	2,910	4·8	4,240
26	1·9	650	4·4	3,390	4·7	4,000
27	2·0	730	4·5	3,580	4·8	4,240
28	1·9	650	5·1	5,050	4·6	3,780
29	1·9	650	5·5	6,320	4·9	4,490
30	1·9	650	5·3	5,660	4·8	4,240
31	....	....	5·5	6,320	....	....

DAILY GAUGE HEIGHTS AND DISCHARGES of Kicking Horse River near Golden for 1913.—*Continued.*

Day.	July.		August.		September.		October.		November.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	5·2	5,350	4·5	3,580	3·8	2,500	2·8	1,420	1·9	650
2	5·1	5,050	4·8	4,240	3·3	1,900	2·8	1,420	1·9	650
3	4·8	4,240	4·7	4,000	3·2	1,790	2·8	1,420	1·8	571
4	4·6	3,780	4·7	4,000	4·7	4,000	2·6	1,240	1·9	650
5	4·4	3,390	4·6	3,780	4·8	4,240	2·5	1,150	2·0	730
6	4·3	3,220	4·8	4,240	4·3	3,220	2·5	1,150	1·9	650
7	5·3	5,660	4·6	3,780	3·9	2,690	2·3	969	1·9	650
8	4·8	4,240	5·0	4,760	3·7	2,370	2·3	979	1·8	571
9	4·8	4,240	4·7	4,000	3·9	2,690	2·2	895	1·8	571
10	4·9	4,490	4·7	4,000	3·7	2,370	2·2	895	1·8	571
11	4·8	4,240	4·5	3,580	3·5	2,130	2·2	895	1·8	571
12	4·5	3,580	4·8	4,240	3·4	2,010	2·3	979	1·8	571
13	4·4	3,390	5·0	4,760	3·5	2,130	2·4	1,060	1·6	416
14	4·2	3,060	4·6	3,780	3·4	2,010	2·4	1,060	1·5	340
15	4·0	2,770	4·3	3,220	3·2	1,790	2·3	979	1·5	340
16	3·8	2,500	4·0	2,770	3·2	1,790	2·3	979	1·8	571
17	3·8	2,500	4·0	2,770	3·1	1,690	2·2	895	1·8	571
18	4·0	2,770	4·5	3,580	3·4	2,010	2·2	895	1·6	416
19	4·3	3,220	3·8	2,500	3·3	1,900	2·1	812	1·5	340
20	4·7	4,000	3·7	2,370	3·1	1,690	2·1	812	1·5	340
21	5·0	4,760	3·6	2,250	3·0	1,600	2·1	812	1·3	201
22	5·1	5,050	3·8	2,500	3·0	1,600	2·1	812	1·3	181
23	5·2	5,350	3·9	2,630	2·9	1,510	2·1	812	1·4	265
24	5·0	4,760	4·1	2,910	2·8	1,420	2·1	812	1·6	416
25	5·1	5,050	4·2	3,060	2·8	1,420	2·0	730	1·7	483
26	5·2	5,350	4·2	3,060	2·8	1,420	2·0	730	1·7	483
27	4·9	4,490	4·1	2,910	2·9	1,510	2·0	730	1·7	483
28	4·8	4,240	4·3	3,220	2·8	1,420	2·0	730	1·7	483
29	4·7	4,000	4·2	3,060	2·8	1,420	2·0	730	1·8	571
30	4·2	3,060	4·5	3,580	2·8	1,420	1·9	650	....	....
31	4·0	2,770	4·2	3,060	....	....	1·9	650	....	....

KICKING HORSE RIVER NEAR FIELD.

Location.—In township 28, range 18, west 5th meridian, below the mouth of Yoho river, on the first traffic bridge, 3¼ miles east of Field.

Records Available.—June to November, 1912; June to December, 1913.

Winter Conditions.—Severe (–40° F.), with heavy snowfall. The river generally remains frozen from the end of November to April. Frazil ice is to be contended with.

Gauge.—A chain gauge is used and read three times a week by Mr. Wm. Oke, of Field, B.C.

Channel.—The channel is straight for 50 yards above and below the station, the water is very swift during freshet, the control fairly permanent.

Discharge Measurements.—Eight well distributed measurements in 1912, and eight in 1913 were made from traffic bridge above mentioned.

Accuracy.—The gauge readings are not frequent. The discharge measurements made in 1913 all agreed to within 2 per cent of the measurements made in 1912. The results at this station are within 10 per cent.

Kicking Horse River near Field, B.C., looking upstream from foot of Canyon.

Discharge Measurements of Kicking Horse River near Field, B.C., for 1912-1913.

Date.	Hydrographer.	Meter No.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
1912.			Feet.	Sq.-ft.	Ft. per sec.	Feet.	Sec.-ft.
June 6	C. E. Richardson	1,048	58	120	2·46	4·4	295
June 25	do	1,048	145	403	8·88	7·0	3,596
June 26	do	1,048	145	488	9·65	7·6	4,710
June 29	do	1,048	145	325	8·05	6·4	2,620
July 2	do	1,048	145	272	7·14	6·0	1,940
Aug. 13	do	1,048	73	192	5·00	5·35	963
Oct. 2	do	1,048	53	102	2·10	3·70	214
Nov. 19	do	1,048	45	738	1·60	3·10	116
1913.							
May 22	do	1,048	60	126	2·40	4·15	300
July 3	do	1,048	73	220	5·82	5·70	1,280
Ju.y 28	do	1,048	88	300	7·40	6·30	2,220
July 30	do	1,048	75	206	5·90	5·55	1,200
July 31	do	1,048	89	281	7·70	6·20	2,190
Aug. 28	R. G. Swan	1,C48	88	297	7·80	6·30	2,300
Sept. 12	do	1,048	61	155	3·20	4·80	496
Dec. 1	C. E. Webb	1,048	45	55·2	1·55	2·95	85·8

Monthly Discharge of Kicking Horse River at Field below Yoho River for 1913.

(Drainage area, 130 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
June	2,870	810	1,696	13,04	14·54	101,000
July	3,050	715	1,872	14·40	16·60	115,000
August	2,870	810	1,900	14·61	16·85	117,000
September	910	300	502	3·86	4·31	29,800
October	275	115	163	1·25	1·44	10,000
November	115	95	106	0·81	0·90	6,310
December	95	75	82	0·63	0·73	5·040

Daily Gauge Heights and Discharges of Kicking Horse River near Field, below the Yoho, River for 1913.

Day.	June.	
	Gauge Height.	Discharge.
	Feet.	Sec.-ft.
1	5·7	1,410
2	5·8	1,550
3	5·9	1,710
4	5·9	1,710
5	5·8	1,550
6	5·7	1,410
7	5·9	1,710
8	6·1	2,030
9	6·3	2,350
10	6·6	2,870
11	6·5	2,680
12	6·4	2,500
13	6·3	2,350
14	6·0	1,870
15	5·7	1,410
16	5·4	1,020
17	5·2	810
18	5·5	1,140
19	5·9	1,710
20	6·2	2,190
21	6·0	1,870
22	5·9	1,710
23	5·7	1,410
24	5·7	1,410
25	5·7	1,410
26	5·6	1,270
27	5·5	1,140
28	5·7	1,410
29	5·8	1,550
30	5·9	1,710
31	....	....

DAILY GAUGE HEIGHTS AND DISCHARGES of Kicking Horse River near Field below Yoho River for 1913—*Continued.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	6·2	2,190	6·3	2,350	5·3	910	4·2	275	3·2	115	3·0	95
2	6·0	1,870	6·3	2·350	5·2	810	4·1	255	3·2	115	3·0	95
3	5·7	1,410	6·4	2,500	5·2	810	4·0	235	3·2	115	3·0	95
4	5·7	1,410	6·6	2,870	5·2	810	3·9	215	3·2	115	3·0	95
5	5·6	1,270	6·5	2,680	5·3	910	3·8	200	3·2	115	3·0	95
6	5·8	1,550	6·4	2,500	5·3	910	3·7	185	3·2	115	3·0	95
7	6·4	2,500	6·3	2,350	5·3	910	3·7	185	3·2	115	3·0	95
8	6·3	2,350	6·2	2,190	5·1	715	3·7	185	3·2	115	3·0	95
9	6·1	2,030	6·1	2,030	5·0	630	3·6	170	3·2	115	2·9	85
10	6·1	2,030	6·1	2,030	4·9	560	3·6	170	3·2	115	2·9	85
11	6·0	1,870	6·2	2,190	4·9	560	3·6	170	3·2	115	2·9	85
12	5·7	1,410	6·4	2,500	4·8	500	3·5	160	3·2	115	2·9	85
13	5·5	1,140	6·3	2,350	4·7	450	3·5	160	3·2	115	2·9	85
14	5·3	910	6·0	1,870	4·6	400	3·5	160	3·1	105	2·8	75
15	5·1	715	5·7	1,410	4·6	400	3·4	145	3·1	105	2·8	75
16	5·1	715	5·5	1,140	4·6	400	3·4	145	3·1	105	2·8	75
17	5·1	715	5·4	1,020	4·5	360	3·4	145	3·1	105	2·8	75
18	5·5	1,140	5·4	1,020	4·5	360	3·4	145	3·1	105	2·8	75
19	5·8	1,550	5·3	910	4·4	330	3·4	145	3·1	105	2·8	75
20	6·1	2,030	5·2	810	4·4	330	3·4	145	3·1	105	2·8	75
21	6·4	2,500	5·3	910	4·3	300	3·4	145	3·0	95	2·8	75
22	6·4	2,500	5·5	1,140	4·3	300	3·4	145	3·0	95	2·8	75
23	6·4	2,500	6·0	1,870	4·3	300	3·4	145	3·0	95	2·8	75
24	6·6	2,870	6·2	2,190	4·3	300	3·4	145	3·0	95	2·8	75
25	6·7	3,050	6·2	2,190	4·3	300	3·3	130	3·0	95	2·8	75
26	6·6	2,870	6·2	2,190	4·3	300	3·3	130	3·0	95	2·8	75
27	6·4	2,500	6·1	2,030	4·3	300	3·3	130	3·0	95	2·8	75
28	6·3	2,350	6·0	1,870	4·3	300	3·3	130	3·0	95	2·8	75
29	6·0	1,870	6·0	1,870	4·3	300	3·3	130	3·0	95	2·8	75
30	6·1	2,030	6·1	2,030	4·3	300	3·2	115	3·0	95	2·8	75
31	6·2	2,190	5·8	1,550	....	....	3·2	115	....	....	2·8	75

KICKING HORSE RIVER NEAR NO. 2 TUNNEL

Location.—In township 28, range 18, west 5th meridian, above mouth of Yoho river, immediately above C.P.R. bridge over the Kicking Horse between No. 1 and No. 2 tunnels, 5 miles east of Field.

Records Available.—July to October, 1912; April to December, 1913.

Gauge.—An enamelled iron vertical staff gauge is used and read twice daily by C. E. Hamilton of Field, B.C.

Channel.—The channel is straight for 25 yards above and below the section. The control appears permanent.

Discharge Measurements.—Measurements are made by the "cable carrier system" described heretofore in this report. Six measurements were made in 1912, and six in 1913.

Accuracy.—Accurate gauge readings are obtained. The discharge measurements seem to vary somewhat with each other. The results are guaranteed to be within 15 per cent.

General.—The differences in discharge between the stations Kicking Horse near Field and Kicking Horse near No. 2 tunnel give the discharge of Yoho river.

Discharge Measurements of Kicking Horse River near No. 2 Tunnel for 1912—1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1912.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
June 28......	C. E. Richardson............	1,048	42	110	4·01	5·00	470
July 2......	"	1,048	40	835	3·58	4·20	299
Aug. 5......	"	1,048	40	944	3·94	4·45	378
Aug. 13......	"	1,048	39	810	3·33	3·85	270
Oct. 2......	"	1,055	30	266	2·24	2·08	[1]59·5
Nov. 19......	"	1,048	15	115	2·70	1·73	[1]30·8
1913.							
May 21......	"	1,048	32	282	2·50	2·45	73·3
July 3......	"	1,048	41	805	4·00	3·85	320
July 28......	"	1,048	40·6	896	3·72	3·90	335
July 30......	"	1,048	38·6	635	3·60	2·50	[2]230
Aug. 28......	"	1,048	40·0	644	3·92	2·38	252
Dec. 1......	C. E. Webb..................	1,048	14·0	108	2·40	0·90	253

Note.—[1]Different section.
[2]Gauge datum raised 1 foot.

Monthly Discharge of Kicking Horse River above mouth of Yoho River for 1913.

(Drainage area, 50 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
April..................................	52	25	34	0·68	0·76	2,020
May..................................	396	17	94	1·88	2·17	5,780
June..................................	770	222	438	8·76	9·77	26,000
July..................................	491	187	341	6·82	7·86	21,000
August..................................	517	204	291	5·82	6·71	17,900
September..................................	351	96	166	3·32	3·70	9,880
October..................................	96	42	60	1·20	1·38	3,690
November..................................	42	25	32	0·64	0·71	1,900
*December..................................	21	21	21	0·42	0·48	1,290

Note.—* Estimated – some gauge readings were affected by ice conditions.

Daily Gauge Heights and Discharges of Kicking Horse River above mouth of Yoho River for 1913.

Day.	April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	....	1·8	17	4·6	491
2	....	....	1·8	17	4·7	517
3	....	....	1·8	17	4·6	491
4	....	....	1·8	17	4·6	491
5	....	....	1·8	17	4·6	491
6	....	....	1·8	17	4·2	396
7	....	....	1·8	17	4·2	396
8	....	....	1·8	17	4·6	491
9	....	....	1·8	17	5·2	667
10	....	....	1·8	17	5·4	734
11	....	....	1·9	25	5·5	770
12	....	....	2·0	33	5·1	634
13	....	....	2·1	42	5·0	603
14	1·9	25	2·1	42	4·8	445
15	1·9	25	2·1	42	4·2	396
16	1·9	25	2·1	42	3·8	305
17	1·9	25	2·1	42	3·6	262
18	2·0	33	2·1	42	3·4	222
19	2·1	42	2·2	52	3·8	305
20	2·2	52	2·3	62	4·8	445
21	2·2	52	2·5	84	4·6	491
22	2·2	52	2·6	96	4·1	373
23	2·1	42	2·7	110	4·0	351
24	2·0	33	2·9	140	4·0	351
25	2·0	33	3·0	115	4·0	351
26	2·0	33	3·2	187	4·1	373
27	2·0	33	3·3	204	3·9	328
28	1·9	25	3·5	242	3·8	305
29	1·9	25	4·0	351	3·9	328
30	1·9	25	4·1	373	4·0	351
31	....	....	4·2	396	....	....

DAILY GAUGE HEIGHTS AND DISCHARGES of Kicking Horse River above mouth of Yoho River for 1913.—*Continued.*

Day.	July.		August.		September.		October.		November.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	4·3	419	3·6	262	3·5	242	2·5	84	2·1	42
2	4·5	466	3·8	305	3·0	155	2·6	96	2·0	33
3	4·0	351	4·0	351	2·9	140	2·6	96	2·0	33
4	3·8	305	4·0	351	3·5	242	2·5	84	2·0	33
5	3·7	283	4·0	351	4·0	351	2·5	84	2·0	33
6	3·6	262	4·0	351	3·5	242	2·5	84	2·0	33
7	4·5	466	4·1	375	3·4	222	2·4	73	2·0	33
8	4·2	396	4·3	419	3·3	204	2·4	73	2·0	33
9	4·0	351	4·0	351	3·5	242	2·3	62	2·0	33
10	4·3	419	3·9	326	3·5	242	2·3	62	2·0	33
11	4·2	396	3·8	305	3·1	170	2·3	62	2·0	33
12	3·8	305	4·0	351	3·1	170	2·3	62	2·0	33
13	3·6	262	4·7	517	3·1	170	2·3	62	2·0	33
14	3·4	222	4·2	396	3·2	187	2·3	62	2·0	33
15	3·4	222	3·9	328	3·0	155	2·3	62	2·0	33
16	3·3	204	3·7	283	3·0	155	2·2	52	2·0	33
17	3·2	187	3·5	242	2·9	140	2·2	52	2·0	33
18	3·4	222	3·5	242	3·0	155	2·2	52	2·0	33
19	3·6	262	3·4	222	3·0	155	2·2	52	2·0	33
20	4·0	351	3·3	204	3·0	155	2·2	52	2·0	33
21	4·4	442	3·3	204	2·9	140	2·2	52	2·0	33
22	4·6	491	3·3	204	2·9	140	2·2	52	2·0	33
23	4·5	466	3·3	204	2·8	185	2·1	42	2·0	33
24	4·4	442	3·4	222	2·7	119	2·1	42	2·0	33
25	4·5	466	3·5	242	2·7	110	2·1	42	2·0	33
26	4·3	419	3·5	242	2·6	96	2·1	42	2·0	33
27	4·1	373	3·6	262	2·6	96	2·1	42	1·9	25
28	3·9	328	3·4	222	2·6	96	2·1	42	1·9	25
29	3·8	305	3·4	222	2·6	96	2·1	42	1·9	25
30	3·6	262	3·5	242	2·6	96	2·1	42	1·9	25
31	3·4	222	3·4	222	....	....	2·1	42	....	....

KOOTENAY RIVER AT GLADE.

Location.—Ten miles from the mouth, below the mouth of Slocan river, 16 miles from Nelson, at the ferry cable near Glade, B.C.

Records Available.—May to December, 1913.

Winter Conditions.—The thermometer seldom goes below zero; the snowfall is fairly heavy; the river never freezes over.

Gauge.—Four 5 foot gauges, reading from 0 to 5 feet, 5 to 10 feet, 10 to 15 feet, and from 15 to 20 feet are used, and read twice daily by F. Striloiff of Glade, B.C.

Channel.—The channel is straight for quarter of a mile above and below section and very uniform. There are riffles 1,000 yards above and below the section which is ideal for metering purposes.

Discharge Measurements.—Seven well-distributed measurements were made during 1913 from a cable car used on a ferry cable.

Accuracy.—Accurate gauge readings are obtained, accurate measurements were taken, and the gauge-height-discharge curve is very satisfactory. The results at this station are guaranteed to be within 5 per cent.

General.—The Kootenay river is one of the largest and most important rivers in British Columbia. It rises in the Beaverfoot range of the Rocky

mountains, in township 24, range 17, west 5th meridian. It flows in practically a southerly direction for 175 miles, where it crosses the border into the state of Montana. It re-enters Canada from Idaho at a point about 60 miles west from where it entered Montana. The river is now flowing almost due north through an extensive area of bottom land which is submerged in high water. About 15 miles from the border the river loses itself in beautiful Kootenay lake, famous to all travellers along the Crowsnest route of the C.P.R. Kootenay lake is 75 miles long—north and south—and from 2 to 6 miles wide. About 30 miles from the southern end of the lake is what is called the west Arm of Kootenay lake. This arm gradually narrows down till about 3 miles west of Nelson, a pronounced riffle shows us that we are once more following a river. From this point to the mouth is a distance of about 25 miles, in which the river falls about 350 feet, affording various power sites including Upper Bonnington and Bonnington falls. The Kootenay discharges into Columbia river shortly below Arrow lakes, and about 25 miles above the international boundary line.

From a hydrographic point there are three outstanding features on the Kootenay.

(1) Power developments and possibilities between Kootenay lake and the mouth of the river.

(2) The possibilities of a reclamation scheme to reclaim thousands of acres of land in Idaho and British Columbia between Kootenay lake and the international boundary line.

(3) Kootenay is an international stream—flowing into Montana from British Columbia, through Idaho back into British Columbia.

1. *Power.*—At the present time there are three power developments on Kootenay river between Kootenay lake and the mouth of the river.

(a) At Upper Bonnington falls the West Kootenay Light and Power Company have a plant which develops 16,000 horse-power, and two extra units are now being added which will increase the capacity to 36,000 horse power. From this plant power is supplied to light Trail, Rossland, Grand Forks, Phœnix, Greenwood, and Eholt; power is supplied to mines at Nelson, Rossland, Greenwood and Phœnix, to the smelters at Trail and Grand Forks, and for irrigation purposes in Grand Forks district. The proposed electrification of the C.P.R. between Rossland and Castlegar will be most probably supplied with power by the same company.

(b) The power-house of the City of Nelson Power and Light Company is located at Upper Bonnington falls also. This development is 1,250 k.w., and supplies power to the city of Nelson for light, for the street railway and for manufacturing purposes, and to a few mines in the vicinity of Nelson.

(c) The West Kootenay Light and Power Company have a development of 4,000 horse-power at Lower Bonnington falls, which is at present used only as an auxiliary plant.

There are various undeveloped sites in this section of the river and it has been estimated that 1,000,000 horse-power (24-hours) may at any time be developed at a low cost per horse-power.

2. *Reclamation.*—Through part of Idaho and that part of British Columbia between the boundary and Kootenay lake, Kootenay river winds its way through a valley from 1 to 3 miles wide. At low and medium stages the river is fairly well confined to a main channel and two or three side channels, but in high water the vast area of bottom land becomes a lake. This bottom land, if reclaimed, is very valuable, and several investigations have already been made, and it is anticipated that more thorough studies will be made in the near future. It is an international proposition.

3. Complications may set in at any time on the international streams and for that reason it is essential to know the amount of water flowing from one country into another where it is at all possible.

Discharge Measurements of Kootenay River near Glade, B.C., 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
June 13......	C. E. R. & H. G. L..........	1,048	720	16,000	9·63	24·5	154,000
July 3......	H. G. L. & A. J. V...........	1,527	706	12,400	8·38	19·8	104,000
" 31......	H. G. L. & A. J. V...........	1,527	655	8,930	6·21	14·6	55,500
Aug. 6......	C. H. R. & J. A. E...........	1,672	660	8,450	6·08	13·85	51,400
Sept. 6......	H. G. L. & A. J. V...........	1,527	600	6,980	4·81	11·50	33,600
Nov. 27......	C. E. R. & A. J. V...........	1,527	550	4,940	3·05	7·82	15,100
1914.							
Jan. 31......	A. J. V. & C. E. W...........	1,048	549	4,620	2·82	7·40	13,000

Note.—This station was established by C. E. Richardson and maintained during 1913 conjointly by W. J. E. Biker, Provincial Water Rights Engineer, Nelson, and the Dominion Hydrographic Survey.

Monthly Discharge of Kootenay River near Glade, B.C., for 1913.

(Drainage area, 19,000 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May..	[1]77,200	32,300	45,400	2·39	2·76	2,790,000
June...	[1]154,000	93,000	126,000	6·63	7·40	7,500,000
July..	108,000	56,300	78,900	4·15	4·78	4,850,000
August......................................	54,700	32,100	42,900	2·26	2·61	2,640,000
September.................................	33,600	23,100	28,600	1·50	1·67	1,700,000
October.....................................	22,100	18,000	19,400	1·02	1·18	1,190,000
November.................................	17,000	15,000	15,900	0·84	0·94	946,000
December..................................	15,000	9,900	12,400	0·65	0·75	762,000

Note.—Kootenay river near Glade, B.C., is 12 miles from mouth.
[1]Deduced by subtracting the discharges of Columbia at Castlegar from that at Trail.

Daily Gauge Heights and Discharges of Kootenay River near Glade, B.C., for 1913.

Day.	June.	
	Gauge Height.	Dis-charge.
	Feet.	Sec.-ft.
1	....	....
2	....	....
3	....	....
4	....	....
5	....	....
6	....	....
7	....	....
8	....	....
9	....	....
10	....	....
11	....	....
12	....	....
13	....	....
14	24·5	154,000
15	22·3	153,000
16	24·0	148,000
17	23·8	146,000
18	23·2	139,000
19	23·0	137,000
20	22·7	134,000
21	22·6	133,000
22	22·2	129,000
23	22·0	127,000
24	21·7	124,000
25	21·5	122,000
26	21·4	120,000
27	21·1	117,000
28	20·9	115,000
29	20·3	109,000
30	20·3	109,000
31	....	....

Daily Gauge Heights and Discharges of Kootenay River near Glade, B.C., for 1913.—*Continued.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	20·2	108,000	14·4	54,700	11·3	32,100	9·5	22,100	8·5	17,000	7·8	15,000
2	20·1	107,000	14·3	53,900	11·2	31,500	9·4	21,600	8·2	16,600	7·8	15,000
3	19·8	104,000	14·2	53,100	11·1	30,900	9·4	21,600	8·2	16,600	7·8	15,000
4	19·65	102,000	14·1	52,300	11·3	32,100	9·3	21,200	8·2	16,600	7·7	14,600
5	19·45	100,000	13·9	50,800	11·55	33,600	9·1	20,400	8·1	16,200	7·7	14,600
6	19·1	97,000	13·8	50,000	11·5	33,300	9·1	20,400	8·1	16,200	7·6	14,200
7	18·85	94,600	13·65	48,900	11·4	32,700	9·0	20,000	8·1	16,200	7·6	14,200
8	18·7	93,200	13·5	47,800	11·4	32,700	9·0	20,000	8·1	16,200	7·5	13,900
9	18·5	91,300	13·5	47,800	11·4	32,700	9·0	20,000	8·1	16,200	7·5	13,900
10	18·25	88,900	13·4	47,000	11·4	32,700	9·0	20,000	8·0	15,800	7·4	13,500
11	18·05	87,000	13·3	46,300	11·4	32,700	8·9	19,600	8·0	15,800	7·4	13,500
12	17·85	85,000	13·25	45,900	11·2	31,500	8·9	19,600	8·0	15,800	7·3	13,100
13	17·65	83,000	13·2	45,500	11·1	30,900	8·8	19,200	8·0	15,800	7·3	13,100
14	17·45	81,000	13·1	44,800	11·0	30,300	8·8	19,200	8·0	15,800	7·2	12,800
15	17·25	79,200	13·0	44,000	10·8	29,100	8·9	19,600	8·0	15,800	7·1	12,400
16	16·95	76,600	12·9	43,200	10·5	27,300	8·8	19,200	8·0	15,800	7·1	12,400
17	16·65	74,000	12·8	42,400	10·5	27,300	8·8	19,200	8·0	15,800	7·0	12,000
18	16·35	71,400	12·7	41,600	10·5	27,300	8·8	19,200	8·0	15,800	7·0	12,000
19	16·15	69,800	12·6	40,800	10·4	26,700	8·8	19,200	8·0	15,800	6·9	11,600
20	15·9	67,600	12·5	40,100	10·3	26,100	8·7	18,800	8·0	15,800	6·9	11,600
21	15·7	65,800	12·4	39,400	10·2	25,600	8·7	18,800	8·0	15,800	6·8	11,300
22	15·7	65,800	12·25	38,400	10·2	25,600	8·7	18,800	8·0	15,800	6·8	11,300
23	15·6	46,900	12·1	37,300	10·1	25,100	8·6	18,400	8·0	15,800	6·7	11,000
24	15·6	64,900	11·9	35,900	10·0	24,600	8·6	18,400	8·0	15,800	6·7	11,000
25	15·5	64,000	11·8	35,200	10·0	24,600	8·6	18,400	8·0	15,800	6·6	10,600
26	15·4	63,100	11·8	35,200	9·9	24,100	8·6	18,400	8·0	15,800	6·6	10,600
27	15·3	62,200	11·7	34,500	9·9	24,100	8·5	18,000	7·9	15,400	6·5	10,200
28	15·1	60,400	11·6	33,900	9·8	23,600	8·5	18,000	7·9	15,400	6·5	10,200
29	15·0	59,500	11·5	33,300	9·8	23,600	8·5	18,000	7·8	15,400	6·5	10,200
30	14·8	57,900	11·4	32,700	9·7	23,100	8·5	18,000	7·8	15,000	6·4	9,900
31	14·6	56,000	11·3	32,100	....	....	8·5	18,000	....	....	6·4	9,900

NO. 2 CREEK.

Location.—No. 2 creek flows easterly into Columbia river from the Selkirk range, about 6 miles from Wilmer. The gauging station is located about 1 mile from the mouth of the highway bridge on road from Wilmer to Forster's Landing.

Records Available.—June to October, 1912; May to December, 1913.

Winter Conditions.—Severe (–40° F.), with light snowfall, as may be found in semi-arid districts in British Columbia. The river is generally frozen from November to April.

Gauge.—A staff gauge is used and read by Mrs. Colin MacKay of Mormish ranch, Wilmer.

Channel.—The channel winds immediately above the section and the water is always very fast; the station is not suitable for metering, but is the most desirable one to be obtained except by erecting a cable station.

Discharge Measurements.—Five measurements in 1912, and eight in 1913 were taken from the highway bridge.

Accuracy.—Accurate gauge heights are obtained, but the measuring section is very poor. These results guaranteed only to be within 15 and 20 per cent.

Discharge Measurements of No. 2 Creek near Forster's Landing for 1912-13.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
1912.							
May 29	H. C. Hughes	1,055	32	64	4·9	0·84	314
June 13	do	1,055	53	114	6·6	1·70	741
July 3	do	1,055	54	114	6·04	1·68	689
" 24	do	1,055	57	116	6·4	1·70	745
Sept. 28	C. E. Richardson	1,055	32	43	4·74	0·40	203
1913.							
May 16	C. E. R. & J. A. E	1,672	35	402	4·58	0·54	[1]184
June 19	J. A. Elliott	1,672	90	161	5·78	1·55	[2]933
July 11	C. E. Richardson	1,048	88	155	7·00	1·70	[3]1,090
" 15	J. A. Elliott	1,672	90	209	6·62	2·00	[3]1,380
" 30	do	1,672	90	130	5·81	1·00	756
Sept. 3	C. E. R. & R. G. S	1,048	70	73	5·50	0·50	404
" 13	J. A. Elliott	1,672	70	71	6·30	0·42	[3]437
Nov. 27	C. E. Webb	1,048	34·5	36·2	3·32	−0·22	120

Note.—[1]Gauge shifted 0′-1″.
[2]New Gauge.
[3]Different section.

Monthly Discharge of No. 2 Creek near Forster's Landing for 1913.

(Drainage area, 200 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May	805	190	306	1·53	1·76	18,800
June	1,930	908	1,223	6·11	6·82	72,600
July	1,320	584	986	4·93	5·68	60,600
August	1,545	486	869	4·35	5·02	53,400
September	1,170	344	501	2·50	2·79	29,800
October	344	216	282	1·41	1·63	17,300
November	257	60	129	0·65	0·73	7,680
December[1]	170	60	106	0·53	0·61	6,520

Note.—[1]Last 10 days in December estimated.

Daily Gauge Heights and Discharges of No. 2 Creek near Forster's Landing for 1913.

Day.	May.		June.	
	Gauge Height.	Dis-charge	Gauge Height.	Dis-charge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	0·4	205	1·9	875
2	0·3	190	2·2	1,110
3	0·3	190	2·1	1,030
4	0·3	190	2·2	1,110
5	0·3	190	2·0	950
6	0·3	190	2·1	1,030
7	0·4	205	1·9	875
8	0·4	205	2·1	1,030
9	0·5	220	2·8	1,930
10	0·5	220	2·8	1,930
11	0·5	220	2·8	1,930
12	0·6	240	2·6	1,770
13	0·5	220	2·5	1,695
14	0·3	190	2·4	1,620
15	0·3	190	1·9	1,245
16	0·3	190	1·6	1,030
17	0·4	205	1·4	908
18	0·4	205	1·4	908
19	0·4	205	1·6	1,030
20	0·4	205	2·2	1,470
21	0·5	220	1·9	1,245
22	0·7	270	1·6	1,030
23	0·9	335	1·6	1,030
24	0·8	300	1·7	1,100
25	1·1	410	1·6	1,030
26	1 2	455	2·0	1,320
27	1·4	555	1·7	1,100
28	1·6	670	1·7	1,100
29	1·7	735	1·8	1,170
30	1·6	670	1·7	1,100
31	1·8	805	....	....

DAILY GAUGE HEIGHTS AND DISCHARGES of No. 2 Creek near Forster's Landing for 1913.—*Continued.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Dis-charge	Gauge Height.	Dis-charge	Gauge Height.	Dis-charge	Gauge Height.	Dis-charge	Gauge Height.	Dis-charge	Gauge Height.	Dis-charge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	1·8	1,170	1·4	908	0·9	634	0·3	344	0·1	257	−0·3	90
2	1·9	1,245	1·7	1,100	0·7	335	0·3	344	0·0	216	−0·3	90
3	1·4	908	2·1	1,395	0·8	584	0·3	344	−0·2	132	−0·4	60
4	1·3	849	2·0	1,320	1·3	849	0·3	344	−0·2	132	−0·2	132
5	1·3	849	1·8	1,170	1·8	1,170	0·2	300	−0·1	257	−0·2	132
6	1·4	908	1·7	1,100	1·0	686	0·1	257	−0·2	132	−0·2	132
7	1·9	1,245	1·8	1,170	0·8	584	0·1	257	−0·1	170	−0·3	90
8	1·7	1,100	2·3	1,545	0·8	584	0·2	300	−0·2	132	−0·3	90
9	1·7	1,100	1·6	1,030	0·7	535	0·3	344	−0·2	132	−0·2	132
10	1·9	1,245	1·5	968	0·6	486	0·3	344	−0·2	132	−0·3	90
11	1·7	1,100	1·5	968	0·5	437	0·2	300	−0·2	132	−0·2	132
12	1·5	968	1·5	968	0·5	437	0·2	300	−0·2	132	−0·2	132
13	1·4	908	1·6	1,030	0·4	390	0·2	300	−0·4	60	−0·2	132
14	1·0	686	1·1	738	0·4	390	0·1	257	−0·4	60	−0·1	170
15	0·9	634	1·0	686	0·3	544	0·1	257	−0·2	132	−0·2	132
16	0·8	584	0·8	584	0·4	390	0·2	300	−0·2	132	−0·3	90
17	0·9	634	0·7	535	0·4	390	0·1	257	−0·2	132	−0·4	60
18	0·9	634	0·7	535	1·0	686	0·1	257	−0·2	132	−0·2	132
19	1·3	849	0·6	486	0·6	486	0·2	300	−0·8	132	−0·2	132
20	1·4	908	0·6	486	0·5	437	0·1	257	−0·2	132	−0·2	132
21	1·8	1,170	0·6	486	0·6	486	0·1	257	−0·4	60	−0·25	111
22	1·9	1,245	0·7	535	0·4	390	0·1	257	−0·4	60	....	....
23	2·0	1,320	1·1	738	0·4	390	0·1	257	....	....	....	....
24	1·9	1,245	1·3	849	0·4	390	0·1	257	....	....	....	....
25	2·0	1,320	1·2	792	0·4	390	0·1	257	....	....	....	....
26	1·8	1,170	1·2	792	0·4	390	0·2	300	....	....	....	....
27	1·6	1,030	1·3	849	0·4	390	0·1	257	−0·2	....	....	....
28	1·6	1,030	1·0	686	0·3	344	0·0	216	....	....	....	....
29	1·5	968	1·3	849	0·5	437	0·0	216	....	....	....	....
30	1·1	738	1·2	790	0·4	390	0·1	257	....	....	....	....
31	1·2	792	1·3	849	....	....	0·1	257	....	....	....	....

OTTERTAIL RIVER

Location.—The gauging section is located in township 27, range 19, west 5th meridian 5½ miles west of Field, just above the highway bridge on road Field to Ottertail. (Old C.P.R. grade.)

Records Available.—June to October, 1912; May to October, 1913.

Winter Conditions.—Winters in this district are very severe, the thermometer going as low as −40° F. The snowfall is heavy, and even in the valleys snow is on the ground for from four to six months in the year. The river is generally frozen from November to April.

Gauge.—The gauge is a vertical staff gauge and is read by Mr. Wm. Haygarth two or three times a week.

Channel.—The channel is straight for 50 yards above and below the section. The water is swift and there are riffles immediately above and below.

Discharge Measurements.—In 1912, four measurements were made from temporary foot-bridge. In 1913, six measurements were made by means of "cable carrier system."

Accuracy.—Gauge readers are infrequent; the measuring section is not very good; these results are guaranteed to be within 15 per cent.

Discharge Measurements of Ottertail River near Field for 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
1913							
May 22	C. E. Richardson	1,048	28	69·6	2·00	2·80	138
July 3	do	1,048	44	110·5	5·41	3·60	598
July 28	do	1,048	44	104·5	4·70	3·50	491
July 31	do	1,048	44	93·5	3·60	3·30	337
Aug. 29	R. G. S. & C. E. R.	1,048	30	91·0	3·70	3·25	337
Dec. 1	C. E. Webb	1,048	34	56·2	1·27	2·40	71

Monthly Discharge of Ottertail River near Field for 1913.

(Drainage area, 90 square miles).

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May	930	40	178	1·98	2·28	10,900
June	1,350	490	829	9·21	10·3	49,300
July	740	290	523	5·81	6·75	32,200
August	740	200	435	4·83	5·57	26,700
September	570	145	269	2·99	3·34	16,000
October	145	85	115	1·28	1·48	7,070

Daily Gauge Heights and Discharges of Ottertail River near Field for 1913.

Day.	May.		June.	
	Gauge Height.	Dis-charge	Gauge Height.	Dis-charge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	2·2	50	4·1	1,030
2	2·2	50	4·2	1,130
3	2·2	50	4·3	1,240
4	2·2	50	4·2	1,130
5	2·1	40	4·1	1,030
6	2·1	40	3·9	830
7	2·2	50	4·0	930
8	2·3	60	4·2	1,130
9	2·4	70	4·4	1,350
10	2·3	60	4·3	1,240
11	2·2	50	4·2	1,130
12	2·3	60	4·1	1,030
13	2·4	70	4·0	930
14	2·4	70	3·8	740
15	2·4	70	3·7	650
16	2·4	70	3·6	570
17	2·3	60	3·5	490
18	2·2	50	3·7	650
19	2·5	85	3·8	740
20	2·6	103	4·0	930
21	2·7	125	3·9	830
22	2·7	125	3·8	740
23	2·8	145	3·7	650
24	2·9	170	3·6	570
25	3·0	200	3·6	570
26	3·2	290	3·5	490
27	3·3	350	3·5	490
28	3·5	490	3·5	490
29	3·7	650	3·6	570
30	3·9	830	3·6	570
31	4·0	930	....	....

DAILY GAUGE HEIGHTS AND DISCHARGES of Ottertail River near Field for 1913.—*Continued.*

Day.	July.		August.		September.		October.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge	Gauge Height.	Discharge	Gauge Height.	Discharge	Gauge Height.	Discharge
	Feet.	Sec. ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	3·8	740	3·5	490	3·2	290	2·7	125	2·4	70
2	3·7	630	3·5	490	3·2	290	2·6	105	....	....
3	3·6	570	3·6	570	3·0	350	2·5	85	....	....
4	3·5	490	3·6	570	3·4	420	2·6	105	....	....
5	3·5	490	3·7	650	3·6	570	2·7	125	....	....
6	3·6	570	3·7	650	3·5	490	2·7	125	....	....
7	3·6	570	3·6	570	3·4	420	2·8	145	....	....
8	3·7	650	3·5	490	3·3	350	2·8	145	....	....
9	3·7	650	3·5	490	3·3	350	2·8	145	....	....
10	3·6	570	3·6	570	3·2	290	2·8	145	....	....
11	3·5	490	3·7	650	3·2	290	2·8	145	....	....
12	3·4	420	3·8	740	3·2	290	2·7	125	....	....
13	3·4	420	3·7	650	3·2	290	2·7	125	....	....
14	3·3	350	3·5	490	3·2	290	2·7	125	....	....
15	3·2	290	3·4	420	3·1	240	2·7	125	....	....
16	3·3	350	3·4	420	3·1	240	2·7	125	....	....
17	3·4	420	3·4	420	3·1	240	2·7	125	....	....
18	3·4	420	3·3	350	3·0	200	2·7	125	....	....
19	3·5	490	3·3	350	3·0	200	2·7	125	....	....
20	3·6	570	3·2	290	3·0	200	2·6	105	....	....
21	3·7	650	3·1	240	3·0	200	2·6	105	....	....
22	3·8	740	3·0	200	3·0	200	2·6	105	....	....
23	3·7	650	3·0	200	3·0	200	2·6	105	....	....
24	3·6	570	3·0	200	3·0	200	2·6	105	....	....
25	3·5	490	3·1	240	2·9	170	2·6	105	....	....
26	3·5	490	3·3	350	2·9	170	2·6	105	....	....
27	3·5	490	3·3	350	2·9	170	2·5	85	....	....
28	3·5	490	3·3	350	2·9	170	2·5	85	....	....
29	3·5	490	3·3	350	2·8	145	2·5	85	....	....
30	3·5	490	3·3	350	2·8	145	2·5	85	....	....
31	3·5	490	3·3	350	....	....	2·5	85	....	....

PEND D'OREILLE RIVER.

(Also commonly called Clark's Fork of Columbia River.)

Location.—The gauging station is located 9 miles above the mouth at Waneta, near Mr. A. G. Lang's ranch.

Records Available.—May to December, 1913.

Winter Conditions.—The winter conditions are not severe in this district, the temperature is seldom below 0° F.; the snowfall is fairly heavy. The river seldom freezes, and never for more than a day or so at a time. It is claimed that the waters of the Pend d'Oreille are warmer than the waters of other streams of British Columbia.

Gauge.—Staff gauges are used and read two or three times a week, except during high water, when they are read daily by Mr. A. G. Lang.

Channel. — The Pend d'Oreille during its course through Canada is very torrential, and there is no favourable metering section. The section chosen is very fast in high water, satisfactory at low water stages, and it appears to have a permanent control.

Discharge Measurements.—Measurements are made from a cable car. To date, twelve well distributed measurements have been made.

Accuracy.—Accurate, though somewhat infrequent gauge readings have been made. Conditions for low-water measurements are favourable, and except

during high water the results are guaranteed to be within 5 per cent; during June and July accuracy is guaranteed to be within 10 per cent.

General.—Pend d'Oreille river has its source in (*a*) British Columbia, on the western slope of the Rocky mountains, where it is known as Flathead river; (*b*) near Helena, Montana, where it is known as Clark's Fork of the Columbia, Missoula river, and several other local names. It drains about 25,500 square miles in Montana, Idaho, and Washington before entering British Columbia, from whence it flows 16 miles in a westerly direction, discharging into the Columbia river at Waneta, B.C., 200 yards from the international boundary, The total drainage area of Pend d'Oreille river is about 26,600 square miles Salmon river drains 480 square miles, being the only important tributary in Canada.

During its course in British Columbia, the Pend d'Oreille has a fall of 423 feet, and four or five sites for large power developments are available. There are not any distinctive falls greater than 10 feet in height. The rise and fall of the river is about 20 feet, and at high water due to narrow and uneven banks and bed the river is very wild.

The gauging and metering section was established in 1912 under the direction of Mr. G. Gray Donald. The cable is $1\frac{1}{4}$ inches in diameter and has a clear span of 610 feet. Measurements are made from a cable car. During 1913, the provincial district engineer, Water Rights Branch, Nelson, and the British Columbia Hydrographic Surveys co-operated on this station until October, when the British Columbia Hydrographic Surveys took complete charge.

Discharge Measurements of Pend d'Oreille River near Waneta, B. C. 1912–13.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1912			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Oct. 11	Wilson			2,900	3·52	3·89	10,200
Nov. 15	do			3,250	4·02	5·14	13,100
1913							
Jan. 25	do			2,550	3·16	2·84	8,070
Feb. 9	do			2,380	2·94	2·24	7,000[1]
Mar. 3	do			2,600	2·92	3·04	7,620
Mar. 24	do			2,710	3·20	3·54	8,660
June 11	W. E. B. & C. E. R.			10,400	11·40	25·25	119,000
June 25	H. G. L.			9,940	10·69	24·20	106,000
July 15	do			7,090	8·40	17·10	59,600
Aug. 4	do			4,780	6·03	10·24	28,800
Sept. 2	do			3,380	4·19	5·41	14,170
Nov. 6	C. E. R. & C. E. W.			2,570	3·16	3·00	8,300

Note.—[1]Ice conditions.

Monthly Discharge of Pend d'Oreille River near Waneta, B. C. for 1913.

(Drainage area, 26,600 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage. area.	Total in acre-feet.
June	116,000	88,000	106,000	3·98	4·44	6,310,000
July	92,900	32,400	59,600	2·24	2·59	3,660,000
August	31,200	14,800	21,500	0·81	0·93	1,320,000
September	14,600	8,580	11,100	0·42	0·47	661,000
October	8,340	7,660	7,920	0·30	0·35	487,000
November	9,780	8,100	8,840	0·33	0·37	526,000
December	9,780	6,200	7,830	0·29	0·33	481,000

Note.—Pend d'Oreille plus Columbia near Trail gives the discharge of the Columbia flowing into the United States.

Daily Gauge Heights and Discharges of Pend d'Oreille River near Waneta, for 1913.

Day.	June.	
	Gauge Height.	Dis-charge
	Feet.	Sec.-ft.
1	21·5	88,000
2	22·0	91,500
3	22·3	93,600
4	22·8	97,200
5	23·0	98,600
6	23·5	102,000
7	24·0	106,000
8	24·6	111,100
9	24·8	112,000
10	25·0	114,000
11	25·1	114,000
12	25·2	115,000
13	25·3	116,000
14	25,3	116,000
15	25·2	115,000
16	25·1	114,000
17	24·9	113,000
18	24·8	112,000
19	24·7	111,000
20	24·6	111,000
21	24·5	110,000
22	24·4	109,000
23	24·3	108,000
24	24·2	108,000
25	24·1	107,000
26	23·6	103,000
27	23·4	102,000
28	23·0	90,600
29	22·7	96,500
30	22·4	94,300

DAILY GAUGE HEIGHTS AND DISCHARGES of Pend d'Oreille River near Waneta, for 1913—*Continued.*

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	22·2	92,900	10·9	31,200	5·6	14,600	3·1	8,340	3·0	8,100	3·7	9,780
2	21·8	90,100	10·7	30,500	5·4	14,000	3·1	8,340	3·0	8,100	3·7	9,780
3	21·5	88,000	10·4	29,400	5·4	14,000	3·0	8,100	3·0	8,100	3·7	9,780
4	21·3	86,600	10·2	28,700	5·4	14,000	2·9	7,880	3·0	8·100	3·6	9,540
5	20·8	83,200	10·0	28,000	5·3	13,800	2·9	7,880	3·0	8,100	3·6	9,540
6	20·4	80,600	9·8	27,300	5·2	13,500	2·9	7,880	3·0	8,100	3·5	9,300
7	20·1	78,700	9·6	26,600	5·0	13,000	2·9	7,880	3·1	8,340	3·4	9,060
8	19·8	76,700	9·4	26,000	4·8	12,500	2·9	7,880	3·1	8,340	3·3	8,820
9	19·5	74,800	9·1	24,900	4·6	12,000	2·9	7,880	3·1	8,340	3·2	8,580
10	19·1	72,200	8·9	24,300	4·5	11,800	2·8	7,660	3·1	8,340	3·2	8,580
11	18·7	69,800	8·7	23,600	4·4	11,500	2·9	7,880	3·2	8,580	3·1	8,340
12	18·3	67,300	9·5	23,000	4·4	11,500	3·0	8,100	3·2	8,580	3·1	8,340
13	18·0	63,500	8·2	22,000	4·3	11,300	2·9	7,880	3·2	8,580	3·0	8,100
14	17·5	62,600	8·0	21,300	4·1	10,800	2·9	7,880	3·2	8,580	2·9	7,880
15	17·1	60,200	7·9	21,000	4·0	10,500	2·9	7,880	3·2	8,580	2·9	7,880
16	16·6	57,400	7·8	20,700	4·0	10,500	3·0	8,100	3·3	8,820	2·8	7,660
17	16·3	55,700	7·6	20,100	3·9	10,300	3·0	8,100	3·3	8,820	2·8	7,660
18	61·0	34,000	7·5	14,800	3·9	10,300	3·0	8,100	3·4	9,060	2·7	7,440
19	15·6	51,900	7·3	19,200	3·8	10,000	3·0	8,100	3·4	9,060	2·7	7,440
20	15·0	48,700	7·2	18,900	3·7	9,780	3·0	8,100	3·4	9,060	2·6	7,220
21	14·7	47,200	7·0	18,300	3·7	9,780	3·0	8,100	3·5	9,300	2·5	7,000
22	14·3	45,300	6·8	17,800	3·7	9,780	2·9	7,880	3·5	9,300	2·4	6,800
23	13·9	43,400	6·7	17,500	3·6	9,540	2·9	7,880	3·5	9,300	2·3	6,600
24	13·5	41,600	6·5	17,000	3·6	9,540	2·9	7,880	3·6	9,540	2·3	6,600
25	13·1	39,800	6·4	16,700	3·5	9,300	2·8	7,660	3·6	9,540	2·3	6,600
26	12·8	38,600	6·3	16,400	3·5	9,300	2·8	7,660	3·6	9,540	2·3	6,600
27	12·5	37,400	6·2	16,100	3·4	9,060	2·8	7,660	3·6	9,540	2·3	6,600
28	12·1	35,800	6·0	15,600	3·3	8,820	2·8	7,660	3·7	9,780	2·2	6,400
29	11·8	34,600	5·9	15,300	3·2	8,580	2·8	7,660	3·7	9,780	2·2	6,400
30	11·4	33,100	5·8	15,100	3·2	8,580	2·8	7,660	3·7	9,780	2·1	6,200
31	11·2	32,400	5·7	14,800	....	....	2·9	7,880	....	....	2·1	6,200

SLOCAN RIVER.

Location.—In Slocan Junction precinct, Nelson water district, about one mile from the mouth on the highway bridge near Crescent Valley.

Winter Conditions.—The snowfall is fairly heavy, but the thermometer rarely falls below zero, and the river seldom freezes.

Gauge.—Vertical staff gauge, fastened to bridge cribbing.

Channel.—Straight above and below the section for 100 yards and inclined to shift.

Discharge Measurements.—Seven well distributed measurements were made in 1913 from the traffic bridge near Crescent valley.

Accuracy.—The meterings are reliable, and the gauge readings are frequent. The channel is shifting, and the control does not appear to be permanent. It is claimed that during high water the Kootenay river causes a backwater effect on the gauge. Accuracy, January to May, 15 per cent; June to August, 20 per cent; September to December, 10 per cent.

General.—The results herewith are obtained through the courtesy of W. J. E. Biker, Provincial Water Rights Engineer, Nelson District, who maintained the station during 1913. These results are published to show the discharge of Kootenay river at Bonnington falls. The British Columbia Hydrographic Survey gauging station on Kootenay river is below the mouth of Slocan river.

MONTHLY DISCHARGE OF Slocan River near Crescent Valley for 1913.

(Drainage area, 2,100 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.		Accuracy
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in Acre-feet.	
January	780	530	655	0·58	0·67	40,300	C
February	850	430	640	0·57	0·59	35,500	C
March	630	280	455	0·38	0·44	28,000	C
April	4,230	350	2,290	2·04	2·28	136,000	C
May	16,160	3,360	9,760	8·71	10·04	600,000	C
June	22,000	10,000	16,000	14·28	15·93	952,000	D
July	10,500	4,230	7,370	6·58	7·59	453,000	D
August	4,140	2,600	3,370	3·01	3·47	207,000	D
September	3,900	2,350	3,120	2·78	3·10	186,000	B
October	2,350	1,600	1,980	1·76	2·03	122,000	B
November	1,700	1,350	1,520	1,36	1,32	90,400	B
December, 1912	950	700	825	0·73	0·84	50,700	C
Year	22,000	280	4,000	3·33	48·50	2,899,900	

SPILLIMACHEEN RIVER.

Location.—The gauging section is located just outside the Railway Belt, about two miles from Spillimacheen Landing on the highway on road up the Spillimacheen valley.

Records Available.—June to October, 1912; June to November, 1913.

Winter Conditions.—The winter conditions in this district are severe (-40 °F.) with heavy snowfall. The river is generally frozen from November to April.

Gauge.—A vertical staff gauge is used and read two or three times a week by J. Montgomery.

Channel.—The channel is straight above and below the section for 50 yards. The control is a gravel bar, and there is a pronounced riffle at low water 25 yards below the section.

Discharge Measurements.—Measurements are made from the downstream side of the highway bridge. In 1912, six measurements were made, and in 1913, eight were made.

Accuracy.—The gauge readings are infrequent, the measuring section is good, there is a possibility of backwater from the Columbia during high water, these results should be within 10 per cent.

Discharge Measurements of Spillimacheen River near Spillimacheen Landing 1912–13.

Date.	Hydrographer.	Meter No	Width.	Area of section.	Mean Velocity.	Gauge Height.	Discharge
			Feet.	Sq. ft	Ft. per sec.	Feet.	Sec.-ft.
1912.							
May 31	H. C. Hughes	1055	119	464	2·43	1·30	1,120
June 17	"	1055	122	585	4·70	2·20	2,740
June 19	"	1055	124	620	5·52	2·55	3,450
July 6	"	1055	122	568	4·18	2·25	2,750
July 19	"	1055	124	599	5·08	2·35	3,040
Sept. 29	C. E. Richardson	1055	114	381	1·45	0·42	554
1913.							
May 20	J. A. Elliott	1672	117	466	2·60	1·17	1,210
June 25	"	1672	123	608	7·39	2·75	4,420
July 11	C. E. Richardson	1048	123	570	6·60	2·60	3,880
July 27	J. A. Elliott	1672	124	613	6·60	2·57	4,070
July 30	"	1672	122	571	4·70	2·10	2,710
Sept. 3	C. E. R and R. G. S.	1048	118	490	3·12	1·50	1,530
Sept. 14	J. A. Elliott.	1672	119	488	3·58	1·57	1,750
Nov 26	C. E. Webb	1048	114	330	1·14	0·25	378

Monthly Discharge of Spillimacheen River near Mouth for 1913.

(Drainage area, 580 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage. area.	Total in Acre-feet.
May	5,130*	1,330	1,916	3·30	3·81	118,000
June	8,000	3,680	5,176	8·92	9·95	308,000
July	5,760	2,270	3,813	6·57	7·57	234,000
August	4,520	1,450	2,925	5·04	5·81	180,000
September	2,700	1,000	1,730	2·98	3·33	103,000
October	1,100	505	822	1·42	1·64	50,500
November	575	380	427	0·73	0·81	25,400

Note.—* May estimated from half month's records.

Daily Gauge Heights and Discharges of Spillimacheen River near Spillimacheen for 1913.

Day.	May. Gauge Height.	May. Discharge.	June. Gauge Height.	June. Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	Estimated mean G. H. = 1·0 for 20 days.	Estimated Discharge = 20,000.	3·1	5,440
2			3·3	6,080
3			3·3	6,080
4			3·2	5,760
5			3·0	5,130
6			2·9	4,820
7			3·0	5,130
8			3·2	5,760
9			3·5	6,630
10			3·7	7,310
11			3·9	8,000
12			3·6	6,970
13			3·3	6,080
14			3·0	5,130
15			2·8	4,520
16			2·6	3,950
17			2·6	3,950
18			2·5	3,680
19			2·7	4,230
20			2·8	4,520
21	1·3	1,330	2·9	4,820
22	1·7	1,890	2·9	4,820
23	2·0	2,480	2·9	4,820
24	2·0	2,480	2·8	4,520
25	2·4	3,420	2·8	4,520
26	2·6	3,950	2·8	4,520
27	2·7	4,230	2·8	4,520
28	2·8	4,520	2·8	4,520
29	2·9	4,820	2·8	4,520
30	3·0	5,130	2·8	4,520
31	3·0	5,130	....	....

Daily Gauge Heights and Discharges of Spillimacheen River near Spillimacheen for 1913.—*Continued.*

Day.	July.		August.		September.		October.		November.	
	Gauge Height.	Discharge.	Gauge Height.	Dischareg.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	2·7	4,230	2·3	3,170	2·0	2,480	1·0	1,000	0·5	575
2	2·7	4,230	2·5	3,680	1·7	1,890	1·1	1,100	0·4	505
3	2·6	3,950	2·6	3,950	1·4	1,450	1·0	1,000	0·3	440
4	2·5	3,680	2·7	4,230	1·7	1,890	1·0	1,000	0·4	505
5	2·4	3,420	2·7	4,230	1·9	2,270	1·0	1,000	0·4	505
6	2·8	4,520	2·8	4,520	2·1	2,700	1·0	1,000	0·4	505
8	3·2	5,760	2·6	3,950	2·0	2,480	1·0	1,000	0·3	440
9	2·8	4,520	2·5	3,680	1·9	2,270	1·0	1,000	0·3	440
9	2·9	4,820	2·4	3,420	1·8	2,070	1·0	1,000	0·3	440
10	2·9	4,820	2·4	3,420	1·7	1,890	1·0	1,000	0·3	440
11	2·7	4,230	2·4	3,420	1·7	1,890	1·0	1,000	0·3	440
12	2·5	3,680	2·4	3,420	1·7	1,890	1·0	1,000	0·3	440
13	2·4	3,420	2·4	3,420	1·8	1,070	1·0	1,000	0·3	440
14	2·3	3,170	2·1	2,700	1·7	1,890	1·0	1,000	0·3	440
15	2·1	2,700	1·9	2,270	1·7	1,890	1·0	1,000	0·3	440
16	2·0	2,480	1·6	1,730	1·7	1,890	1·0	1,000	0·3	440
17	2·0	2,480	1·6	1,730	1·7	1,890	0·7	730	0·3	440
18	2·0	2,480	1·5	1,580	2·1	2,700	0·7	730	0·2	380
19	2·3	3,170	1·5	1,580	1·7	1,890	0·7	730	0·2	380
20	2·6	3,950	1·4	1,450	1·5	1,580	0·6	650	0·2	380
21	2·7	4,230	1·7	1,890	1·3	1,330	0·6	650	0·2	380
22	2·8	4,520	2·0	2,480	1·2	1,210	0·6	650	0·2	380
23	3·0	5,130	2·2	2,930	1·1	1,100	0·6	650	0·2	380
24	2·9	4,820	2·1	2,700	1·1	1,100	0·6	650	0·2	380
25	2·9	4,820	2·1	2,700	1·1	1,100	0·5	575	0·2	380
26	2·7	4,230	2·1	2,700	1·1	1,100	0·5	575	0·2	380
27	2·5	3,680	2·1	2,700	1·0	1,000	0·5	575	0·2	380
28	2·3	3,170	2·1	2,700	1·0	1,000	0·5	575	0·2	380
29	2·1	2,700	2·1	2,700	1·0	1,000	0·5	575	0·2	380
30	1·9	2,270	2·1	2,700	1·0	1,000	0·5	575	0·2	380
31	2·2	2,930	2·2	2,930	....	....	0·4	505	....	....

TOBY CREEK.

Location.—One and one half miles from Athalmer, one mile from mouth, on highway bridge on road from Athalmer to Wilmer.

Records Available.—June to September, 1912; May to October, 1913.

Winter Conditions.—The winter conditions are severe in this district, the snowfall is light, as in all semi-arid districts in British Columbia. The river is generally frozen over from November to April.

Gauge.—A vertical staff gauge is used and read by Mr. A. L. Peters, Cyderdale Ranch, Wilmer.

Channel.—The section is not at all suitable for metering, but is the only one available without erecting a cable station, the channel is not straight and the bed is shifting. The water is not at right angles to the bridge and is swift.

Discharge Measurements.—Five measurements were taken in 1912, and nine in 1913, from the highway bridge. These measurements are not reliable.

Accuracy.—The gauge readings are good, the measurements are not reliable; there is a possibility of backwater from the Columbia. Accuracy 20 per cent (guaranteed), but probably within 10 per cent.

Discharge Measurements of Toby Creek near Athalmer, 1912, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1912.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
May 28......	C. E. R. & H. C. H...........	1,055	168	359	2·22	2·00	797
June 29......	H. C. Hughes..................	1,055	167	397	2·80	2·48	1,110
June 14......	"	1,055	167	423	3·00	2·60	1,270
July 23......	"	1,055	167	378	3·03	2·25	1,140
Sept. 28......	C. E. Richardson.............	1,055	160	122	2·27	0·46	[1]270
1913.							
May 17......	J. A. Elliott....................	1,672	168	202	2·10	1·70	[2]424
June 2......	do	1,048	175	616	4·30	3·74	2,650
June 20......	do	1,672	173	578	4·20	3·78	[3]2,420
July 11......	C. E. Richardson.............	1,048	170	440	3·50	3·20	1,560
July 25......	J. A. Elliott....................	1,672	170	418	4·42	3·22	1,850
July 30......	do	1,672	170	324	3·36	2·60	1,090
Sept. 3......	C. E. R. & R. G. Swan........	1,048	160	246	2·46	2·20	644
Sept. 13......	J. A. Elliott....................	1,672	158	231	2·93	2·20	[3]676
Nov. 27......	C. E. Webb....................	1,048	....	....	....	....	[4]140

Note.—[1]Different section.
[2]New gauge.
[3]Different section.
[4]Ice conditions.

Monthly Discharge of Toby Creek near Mouth (highway bridge) for 1913.

(Drainage area, 220 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May[1]................	2,290	295	726	3·30	3·81	44,600
June....................	3,650	1,200	2,133	9·70	10·82	126,700
July....................	2,470	690	1,487	6·76	7·79	91,000
August..................	1,960	690	1,230	5·59	6·45	75,600
September...............	1,530	445	713	3·24	3·62	42,400
October.................	555	395	441	2·00	2·31	27,100

Note.—[1]First 17 days estimated.

Daily Gauge Heights and Discharges of Toby Creek near Mouth for 1913.

Day.	May.		June.		July.		August.		September.		October.	
	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.	Gauge Height.	Dis-charge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	....	3·55	2,205	3·55	1,885	3·2	1,670	2·7	1,100	1·9	495
2	....	....	3·65	2,380	3·3	1,810	3·2	1,670	2·3	765	2·0	555
3	....	....	3·8	2,660	2·95	1,355	3·2	1,670	2·3	765	1·9	495
4	....	....	3·7	2,470	3·0	1,410	3·4	1,960	2·3	765	1·9	495
5	....	....	3·5	2,120	2·9	1,300	3·2	1,670	3·1	1,530	1·9	495
6	....	....	3·4	1,960	3·0	1,410	3·2	1,670	2·55	965	1·85	470
7	....	....	3·5	2,120	3·4	1,960	3·2	1,670	2·35	800	1·85	470
8	....	....	4·2	3,450	3·25	1,740	3·15	1,600	2·3	765	1·85	470
9	....	....	4·3	3,650	3·2	1,670	3·1	1,530	2·4	840	1·85	470
10	....	....	4·3	3,650	3·2	1,670	3·1	1,530	2·2	690	1·85	470
11	....	....	3·9	2,850	3·1	1,530	2·9	1,300	2·0	555	1·85	470
12	....	....	3·95	2,950	3·2	1,670	3·0	1,410	1·8	445	1·9	495
13	....	....	4·0	3,050	2·6	1,010	2·8	1,200	2·2	690	1·95	525
14	....	....	3·4	1,960	2·5	920	2·6	1,010	2·1	620	1·9	495
15	....	....	3·0	1,410	2·2	690	2·5	920	2·0	555	1·8	445
16	....	....	2·95	1,355	2·4	840	2·3	765	2·0	555	1·8	445
17	....	....	2·8	1,200	2·4	840	2·3	765	2·2	690	1·7	395
18	1·7	395	2·8	1,200	2·6	1,010	2·3	765	2·7	1,100	1·7	395
19	1·7	395	3·5	2,120	3·05	1,470	2·2	690	2·2	690	1·7	395
20	1·75	420	3·4	1,960	3·2	1,670	2·2	690	2·2	690	1·7	395
21	1·9	495	3·2	1,670	3·2	1,670	2·3	765	2·2	690	1·7	395
22	2·2	690	3·15	1,600	3·45	2,040	2·6	1,010	2·2	690	1·7	395
23	2·5	920	3·2	1,670	3·7	2,470	2·6	1,010	2·0	555	1·7	395
24	2·6	1,010	3·2	1,670	3·5	2,120	2·9	1,300	2·0	555	1·7	395
25	2·8	1,200	3·25	1,740	3·2	1,670	2·85	1,250	2·0	555	1·7	395
26	3·0	1,410	3·4	1,960	3·1	1,530	2·7	1,100	2·0	555	1·7	395
27	3·3	1,810	3·3	1,810	3·1	1,530	2·5	920	2·0	555	1·7	395
28	3·45	2,040	3·2	1,670	3·0	1,410	2·7	1,100	2·0	555	1·7	395
29	3·45	2,040	3·2	1,670	2·9	1,300	2·9	1,300	2·0	555	1·7	395
30	3·6	2,290	3·3	1,810	2·9	1,300	2·7	1,100	2·0	555	1·7	395
31	3·6	2,290	....	....	2·8	1,200	2·7	1,100	....	....	1·7	395

YOHO RIVER.

General.—There is no regular gauging station on Yoho river. The discharges are deduced from the discharges of Kicking Horse river, above and below the mouth of the Yoho i.e. near No. 2 tunnel, and near Field.

Winter Conditions.—The winter conditions are very severe in the Yoho drainage, the thermometer dropping as low as -50 °F.. The snowfall is very heavy, particularly in the upper reaches. The river remains frozen for three or four months each year.

Monthly Discharge of Yoho River at Mouth for 1913.

(Drainage area, 75 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
June	2,140	548	1,260	16·8	18·7	74,500
July	2,580	493	1,530	20·4	23·5	94,100
August	2,520	606	1,610	21·4	24·7	99,000
September	770	160	342	4·6	5·1	20,400
October	191	73	103	1·4	1·6	6,330
November	82	62	74	1·0	1·1	4,400

Note.—Discharges deduced from discharges obtained on Kicking Horse river above and below mouth of Yoho river.

Takakkaw Falls—Yoho Valley near Field, B.C.

DAILY DISCHARGES of Yoho River near Field for 1913.

Day.	June.	July.	August.	September.	October.	November.
	Discharge.	Discharge.	Discharge.	Discharge.	Discharge.	Discharge.
	Sec.-ft.	Sec.-ft.	Sec.-ft.	Sec.-ft.	Sec.-ft.	Sec.-ft.
1	919	1,771	2,088	668	191	73
2	1,033	1,404	2,045	755	159	82
3	1,219	1,059	2,149	770	139	82
4	1,219	1,105	2,519	568	131	82
5	1,059	987	2,329	559	116	82
6	1,014	1,288	2,149	668	111	82
7	1,314	2,034	1,977	688	112	82
8	1,539	1,954	1,771	511	112	82
9	1,683	1,679	1,679	388	108	82
10	2,136	1,611	1,702	318	108	82
11	1,910	1,474	1,885	390	108	82
12	1,866	1,105	2,149	330	98	82
13	1,747	878	1,833	280	98	82
14	1,425	688	1,474	213	98	72
15	1,014	493	1,082	245	83	72
16	715	511	857	245	93	72
17	548	528	778	220	93	72
18	918	918	778	205	93	72
19	1,405	1,288	688	175	93	72
20	1,745	1,679	606	175	93	72
21	1,379	2,058	706	160	93	62
22	1,337	2,009	936	160	93	62
23	1,059	2,034	1,666	175	103	62
24	1,059	2,428	1,968	190	103	62
25	1,059	2,584	1,948	190	88	62
26	897	2,451	1,948	204	88	62
27	812	2,127	1,768	204	88	70
28	1,105	2,022	1,648	204	88	70
29	1,222	1,565	1,648	204	88	70
30	1,359	1,768	1,788	204	73	70
31	....	1,968	1,328	....	73	....

MISCELLANEOUS METERING STATIONS.

INCOMAPPLEUX RIVER.

Location.—Immediately outside the Southern limit of the Railway Belt 2 miles from the mouth near Beaton, on the Northeast Arm, Arrow Lakes.

Winter Conditions.—The snowfall is heavy but the temperature (-30 °F.) is milder than at Revelstoke, the river freezes over for two or three months each year.

Gauge.—Due to a probable effect of backwater, the gauge could not be located on the bridge between Commapleux and Beaton, from which measure, ments are made. A staff gauge was established near Burbidge's ranch in May-but due to excessive highwater and drift wood it was washed out in June. A new gauge was set in a slightly different location and tied into same bench marks. This gauge was found to be in riffle in low water, and a third gauge was set. No relation could be obtained between the three gauges.

Channel.—At the gauge the water is fast, the control has not been studied, the measuring section is satisfactory.

Discharge Measurements.—Seven well distributed measurements were obtained in 1913.

Accuracy.—Due to great trouble with the gauge reliable daily discharges were not obtained, so the results are not published. The Incomappleux and

Illecillewaet appear to be similar streams. The drainage areas are about the same, but the discharge of the Incomappleux during the summer months appears about 30 per cent in excess of the Illicillewaet. During the winter it appears to fall lower than the Illecillewaet.

Discharge Measurements of Incomappleux River near Beaton for 1913.

		Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
May 8	C. E. R. & J. A. E.	1,048	100	635	2·80	2·28	1,800
" 28	J. A. E.	1,672	96	1,130	7·63	4·90	[1]8,632
July 8	J. A. E.	1,672	98	966	6·16	5·50	5,932
" 18	J. A. E.	1,672	100	1,056	5·82	5·02	6,130
Aug. 11	J. A. E.	1,672	90	1,097	5·39	5·60	5,940
Sept. 18	R. G. S. & C. E. R.	1,048	98	830	4·91	4·87	4,080
Nov. 21	C. E. W.	1,048	93	526	1·13	2·40	597

Note.—[1]Fair measurement.

Monthly Discharge of Columbia River at International Boundary Line for 1913.

(Drainage area, 61,000 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
June	428,000	279,000	368,000	6·03	6·73	21,900,000
July	329,000	186,000	241,000	3·95	4·55	14,800,000
August	184,000	113,000	146,000	2·39	2·76	8,980,000
September	112,000	70,700	94,600	1·55	1·73	5,630,000
October	68,800	47,200	54,800	0·90	1·04	3,370,000
November	47,400	37,100	41,000	0·67	0·75	2,440,000
December	37,600	24,800	30,400	0·50	0·58	1,870,000

Note.—Deduced by adding discharges of Pend d'Oreille and Columbia at Trail.

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